

LAMONT-DOHERTY GEOLOGICAL OBSERVATORY OF

COLUMBIA UNIVERSITY

Palisades, New York 10964

LAMONT-DOHERTY SURVEY OF THE WORLD OCEAN

General Editor, Maurice Ewing

Preliminary Report of Volume 20
U.S.N.S. ELTANIN
CRUISES 16-21
January, 1965 - January, 1966

Part A

NAVIGATION

and

Part B

BATHYMETRIC AND GEOMAGNETIC
MEASUREMENTS

James R. Heirtzler, Dennis E. Hayes, Ellen M. Herron, and Walter C. Pitman III

Technical Report No. 3-CU-3-69
National Science Foundation Grant GA-894

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INTRODUCTION

The purpose of this report is to present navigation, bathymetric, and geomagnetic data collected aboard U.S.N.S. ELTANIN during cruises 16-21 inclusive. These data and those obtained on other U.S.N.S. ELTANIN cruises constitute a significant portion of all existing measurements of this type for high latitude in the southern ocean. A major part of the data presented here have not yet been studied in detail, although some segments of it have been used in publications. Because of the current interest in the analysis of marine geomagnetic anomalies and marine morphology in terms of global tectonic processes, the data should be made available in preliminary form. A substantial effort on the part of many individuals has gone into the collection and reduction of approximately 40,000 nautical miles of data summarized here. These cruises are much shorter than the typical ones reported in this series of publications. To facilitate use of the same format throughout the series, the individual cruises in this volume will be treated as though each were one leg of a longer cruise.

The main contents of the report are introductory matter, tabulations of navigational information in Part A, and profiles of topography and total magnetic field intensity anomaly plotted against distance along the ship's track, in Part B. Index maps show the ship's track and indicate distance along the track by means of tick marks at intervals of 100 nautical miles. These maps and the lists of navigational data allow one to obtain the geographic coordinates for any point or section of the plotted profiles. The profiles of topography are plotted at a vertical exaggeration of 100:1. The units of depth used are nominal fathoms (1/400

sec reflection time). Geomagnetic anomalies are plotted in gammas (10^5 gammas = 1 oersted). They are obtained by subtracting the regional magnetic field from the observations of the total magnetic field as described in the section on data reduction. The topographic and geomagnetic profiles are plotted with respect to distance, which is annotated at intervals of 200 nautical miles near the bottom of each profile. In addition, tick marks shown below the distance scale indicate the distance at which any change in course or speed occurred. The course and speed at any time (or distance) can be determined by examining the navigational listings. West longitudes are designated as negative as are the south latitudes. All times are Greenwich Mean Times. Mileage is accumulated distance in nautical miles along the ship's track, reset to zero at the beginning of each new cruise. The course and speed applies to the time interval following the entry.

INSTRUMENTATION

A Varian proton precession magnetometer was used for all magnetic measurements. The instrument was towed approximately 800 ft. astern of the ship. The accuracy of this type of instrument has been discussed by many (e.g. Heirtzler, 1961, Bullard and Mason, 1963) and is generally accepted to be about ± 10 -15 gammas. Data were recorded continuously on an analog strip chart recorder and also digitally on punched paper tape at a one minute sampling interval.

A 12 KHZ transducer with an effective half angle of 30° was used with a Times Facsimile recorder for the precision depth measurements. Relative depths can be resolved to about one fathom ($1/400$ sec reflection time) in any depth in regions of low to moderate relief. Side echoes

are common in areas of high relief and the resolution of small amplitude relief is extremely difficult in such areas.

For ELTANIN Cruises 16-19 inclusive the primary source of navigation was celestial navigation supplemented by dead reckoning information (E-M log and gyrocompass). Under extremely favorable conditions, celestial fixes can be obtained with an accuracy of about ± 1 nautical mile. Weather conditions during the austral winter were such that reliable celestial fixes were sometimes separated by several days. Under these conditions, the inferred position of the ship during these intervals could be in error by several tens of miles. No attempt has been made here to evaluate these errors by comparing uncertain tracks with satellite controlled tracks for discrepancies in observed geophysical parameters (e.g. depth). This could be done, but a unique solution for resolving the discrepancies would be unlikely in view of the sparse number of ship's tracks in the areas in question. The users of this data should allow for the fact that data collected on cruises 16-19 are subject to large positional uncertainties.

Beginning with ELTANIN Cruise 20 the Navy navigation satellite system (Guier, 1966) was used to obtain frequent and precise fixes. The ship's electromagnetic (E-M) log and gyrocompass were used by navigating officers to interpolate the ship's track between satellite fixes. Some experiences with the satellite navigation system at sea have been reported by Talwani et al. (1966).

The digitized navigation data contained in this report were taken directly from the daily deck logs at each change of course or speed. Positions as found in the deck log are given only to the nearest whole minute of latitude and longitude. Positions based on satellite naviga-

tion should be generally accurate to one nautical mile, though errors of five nautical miles or more are possible under extremely unfavorable conditions.

Occasionally obvious errors are present in the deck log entries and these have been corrected in the digitized navigational data.

DATA REDUCTION

All data were digitized and reduced with the aid of an IBM 1620 digital computer and on-line Calcomp plotter. The navigational information (time, latitude, longitude) is first put in digital form and stored in the computer. All data (depth and total field) are then reduced in terms of geographic coordinates and distance along the track, using time as the dependent variable. The precision echo-grams were digitized on a Thomson digitizing table at an irregular sampling interval of one to 15 minutes, depending on the relief. The average sampling represents about one sounding per nautical mile. Topographic relief of smaller wavelength cannot be usefully resolved on plots at the scales presented here. Slope corrections have not been applied and the soundings plotted here have not been corrected for variation of sound velocity in water. The latter corrections are of the order of 100 fm in about 3000 fm in water. The bathymetric reduction program allows the user the option to apply sound velocity corrections according to Matthews 1939 tables.

The magnetometer data were introduced into the computer by either digitizing the analog records or by using the carefully edited digital punched tape--depending on the quality of the respective records. The geographic coordinates and track distance were computed for each sampling point, again using the navigational data with time as the dependent

variable. The regional field was determined, using a modified computer program (Heirtzler and Nabighian) from the Goddard Space Flight Center, which describes the regional field by spherical harmonics of degree and order 7 (Cain et al., 1964).

No indications have been given about magnetically quiet or disturbed days and no corrections have been applied for diurnal variations of the magnetic field. The latter variations are of the order of 50 gammas per day in the area of interest and would have long apparent wavelengths not likely to be confused with anomalies arising from sources in the earth's crust. Secular variations are effectively removed as part of the regional field by considering the time derivatives of the harmonic coefficients which define the regional field.

ACKNOWLEDGEMENTS

The data presented here are the result of conscientious efforts by many individuals. These include technicians, scientists, ship's personnel and administrators. Although it is impossible to acknowledge each individual by name, the contribution of these individuals is recognized and gratefully acknowledged. The computerized data processing techniques used were developed in large part by M. Talwani. The following persons were responsible for a substantial part of the data reduction: E. Haff, M. Schneck, T. Stillman, T.S. Applegate. The research was supported by the National Science Foundation under grants NSF GA-305, NSF GA-175, NSF GA-894, NSF GA-1121, NSF GA-1523.



Lamont-Doherty Geological Observatory Personnel - Geophysics Party-
Aboard U.S.N.S. ELTANIN

<u>Cruise #16</u>	28/I/65 -	25/II/65
	Auckland, N.Z.	Wellington, N.Z.

Robert Houtz
David Massey
Lawrence Oblinger
James Raymond
Donald Wickland

<u>Cruise #17</u>	12/III/65 -	13/V/65
	Wellington, N.Z.	Valparaiso, Chile

Robert Leyden
David Massey
Lawrence Oblinger
Fred Rosselot
Thomas Wustenberg

<u>Cruise #18</u>	25/V/65 -	16/VI/65
	Valparaiso, Chile	Talcahuano, Chile

David Massey
Lawrence Oblinger
Thomas Wustenberg

<u>Cruise #19</u>	6/VII/65 -	3/IX/65
	Talcahuano, Chile	Auckland, N.Z.

George Carpenter
David Massey
Lawrence Oblinger
Thomas Wustenberg

<u>Cruise #20</u>	14/IX/65 -	12/XI/65
	Auckland, N.Z.	Valparaiso, Chile

Ellen Herron
Lawrence Oblinger
Walter Pitman
Thomas Wustenberg

<u>Cruise #21</u>	23/XI/65 -	7/I/66
	Valparaiso, Chile	Punta Arenas, Chile

David E. Epp
Bruce F. Molnia
Lawrence Oblinger
Thomas Wustenberg

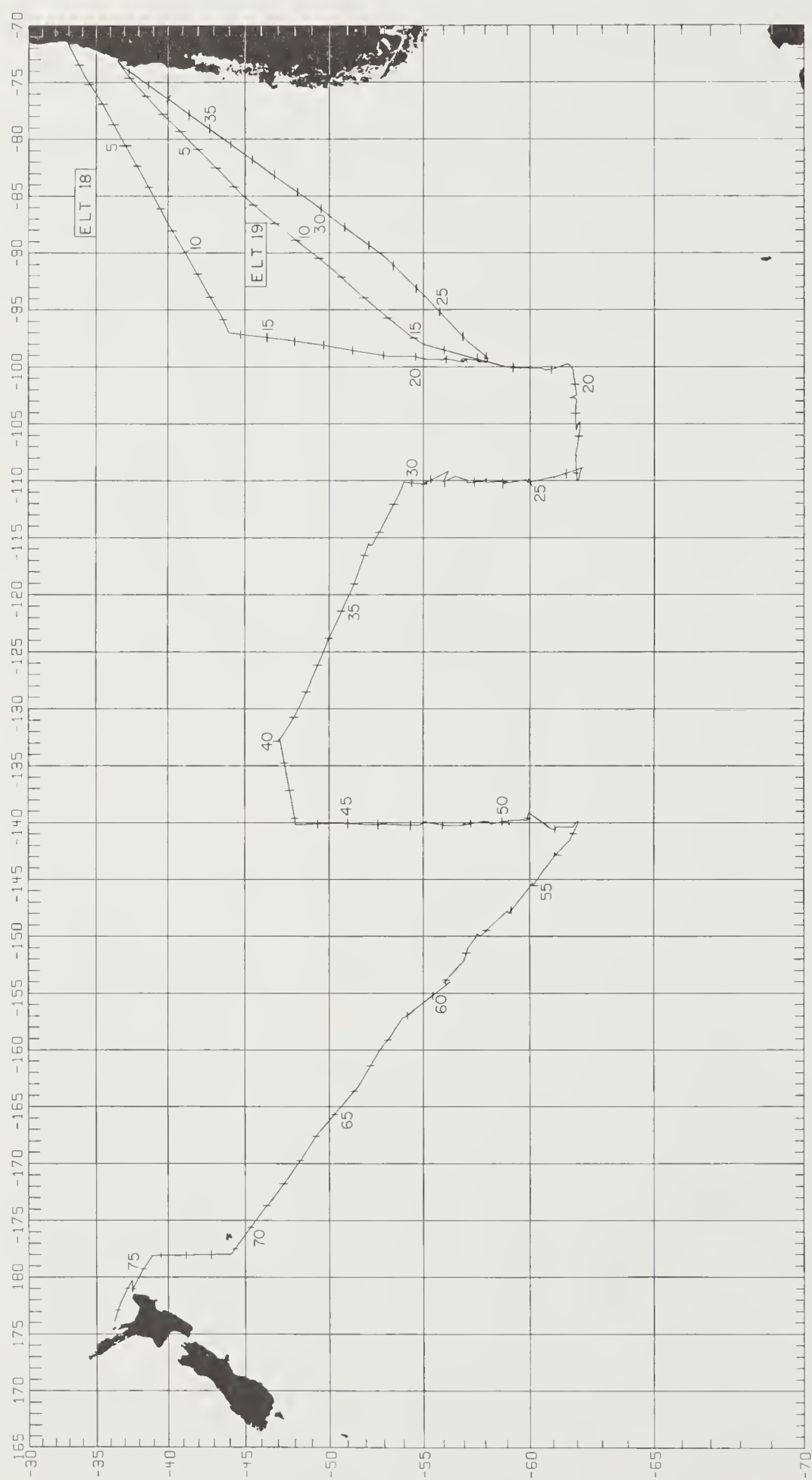


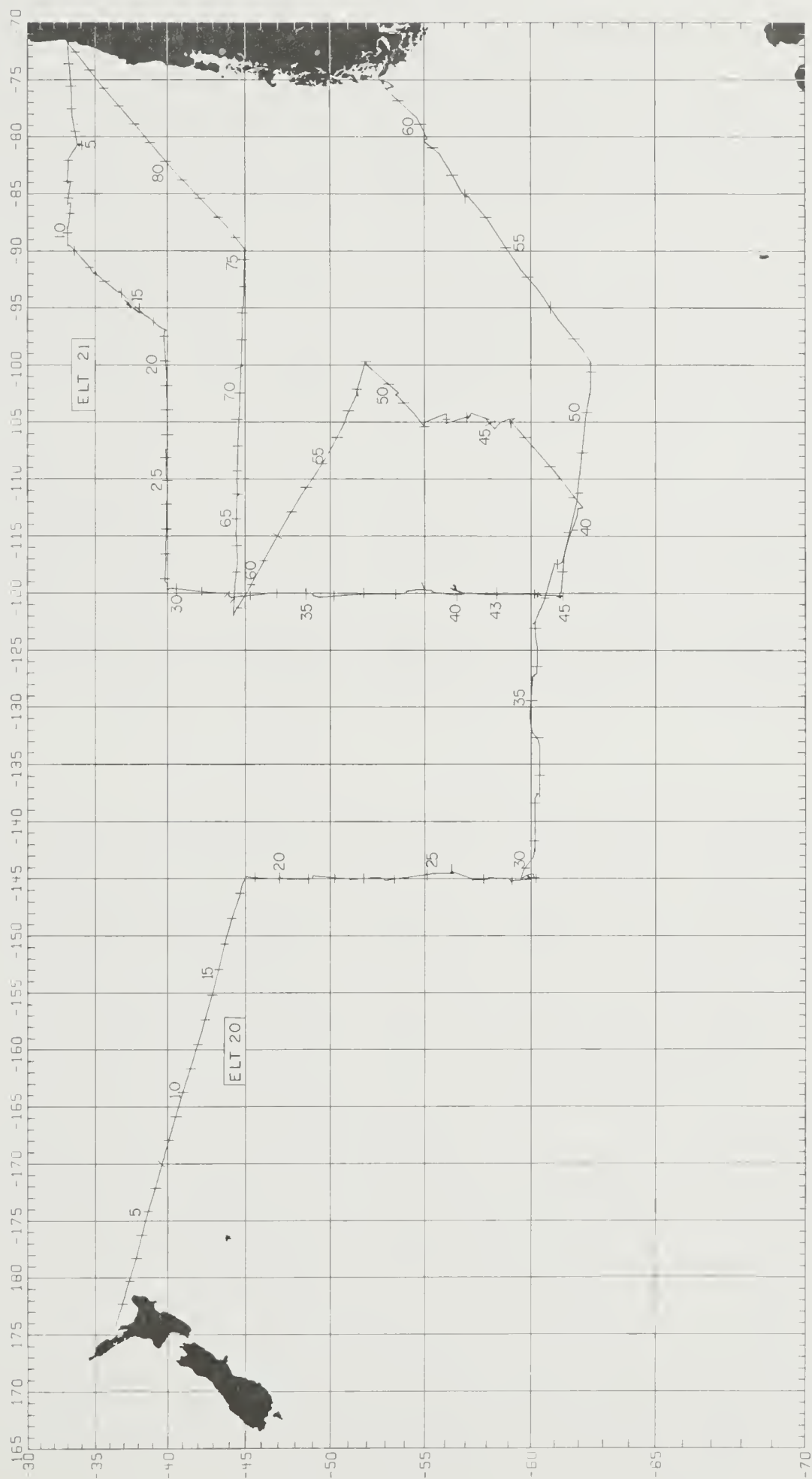
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ELTANIN 16 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS	409.6	1830	29	1	-40	34.0	179	16.0	255	9.8
0.0	18	28	1	-36 46.0	174 49.0	90	0.0	413.5	1854	29	1	-40	35.0	179	11.0	257	8.5
0.0	24	28	1	-36 46.0	174 49.0	44	10.9	431.4	2100	29	1	-40	39.0	178	48.0	258	9.3
6.9	102	28	1	-36 41.0	174 55.0	50	11.8	436.0	2130	29	1	-40	40.0	178	42.0	249	11.3
33.2	315	28	1	-36 24.0	175 20.0	90	8.7	441.7	2200	29	1	-40	42.0	178	35.0	263	8.3
34.8	326	28	1	-36 24.0	175 22.0	102	10.2	450.1	2300	29	1	-40	43.0	178	24.0	257	8.9
39.7	355	28	1	-36 25.0	175 28.0	90	5.6	468.0	100	30	1	-40	47.0	178	1.0	270	9.7
41.4	412	28	1	-36 25.0	175 30.0	104	8.2	474.8	142	30	1	-40	47.0	177	52.0	217	12.5
45.5	442	28	1	-36 26.0	175 35.0	116	9.6	476.1	148	30	1	-40	48.0	177	51.0	259	8.7
50.0	510	28	1	-36 28.0	175 40.0	103	7.2	492.2	339	30	1	-40	51.0	177	30.0	270	8.2
63.2	700	28	1	-36 31.0	175 56.0	141	6.4	493.8	350	30	1	-40	51.0	177	28.0	256	9.5
64.5	712	28	1	-36 32.0	175 57.0	114	12.2	531.1	745	30	1	-41	0.0	176	40.0	270	15.0
86.5	900	28	1	-36 41.0	176 22.0	90	9.6	531.9	748	30	1	-41	0.0	176	39.0	236	9.0
88.1	910	28	1	-36 41.0	176 24.0	113	12.5	533.7	800	30	1	-41	1.0	176	37.0	236	7.2
98.5	1000	28	1	-36 45.0	176 36.0	117	10.5	535.5	815	30	1	-41	2.0	176	35.0	221	12.3
156.6	1530	28	1	-37 11.0	177 41.0	110	10.2	544.7	900	30	1	-41	9.0	176	27.0	230	10.2
180.3	1748	28	1	-37 19.0	178 9.0	109	7.7	596.4	1402	30	1	-41	42.0	175	34.0	270	9.9
189.5	1900	28	1	-37 22.0	178 20.0	122	9.3	599.4	1420	30	1	-41	42.0	175	30.0	270	6.4
191.4	1912	28	1	-37 23.0	178 22.0	104	8.7	600.1	1427	30	1	-41	42.0	175	29.0	90	0.0
195.5	1940	28	1	-37 24.0	178 27.0	142	9.5	600.1	1441	30	1	-41	42.0	175	29.0	294	.7
196.8	1948	28	1	-37 25.0	178 28.0	136	9.7	602.6	1800	30	1	-41	41.0	175	26.0	270	.4
209.3	2105	28	1	-37 34.0	178 39.0	130	7.4	603.3	1935	30	1	-41	41.0	175	25.0	90	0.0
212.4	2130	28	1	-37 36.0	178 42.0	122	7.4	603.3	2000	30	1	-41	41.0	175	25.0	270	1.4
214.3	2145	28	1	-37 37.0	178 44.0	142	15.3	604.8	2100	30	1	-41	41.0	175	23.0	217	1.5
218.1	2200	28	1	-37 40.0	178 47.0	152	10.1	606.1	2148	30	1	-41	42.0	175	22.0	270	6.3
228.3	2300	28	1	-37 49.0	178 53.0	122	18.6	606.8	2155	30	1	-41	42.0	175	21.0	90	0.0
230.1	2306	28	1	-37 50.0	178 55.0	150	14.0	606.8	2200	30	1	-41	42.0	175	21.0	270	8.9
242.8	0	29	1	-38 1.0	179 3.0	166	8.0	609.0	2215	30	1	-41	42.0	175	18.0	270	8.9
265.5	249	29	1	-38 23.0	179 10.0	142	5.4	611.3	2230	30	1	-41	42.0	175	15.0	315	10.1
266.8	303	29	1	-38 24.0	179 11.0	171	8.7	615.5	2255	30	1	-41	39.0	175	11.0	0	12.0
301.2	700	29	1	-38 58.0	179 18.0	163	9.0	616.5	2300	30	1	-41	38.0	175	11.0	300	12.0
328.3	1000	29	1	-39 24.0	179 28.0	174	9.1	622.6	2330	30	1	-41	35.0	175	4.0	307	13.1
344.4	1145	29	1	-39 40.0	179 30.0	176	9.5	629.1	0	31	1	-41	31.0	174	57.0	307	11.6
394.6	1700	29	1	-40 30.0	179 35.0	253	10.3	635.7	34	31	1	-41	27.0	174	50.0	0	12.0
404.9	1800	29	1	-40 33.0	179 22.0	258	9.3	636.7	39	31	1	-41	26.0	174	50.0	270	7.4

ELT. 16 NAVIGATION CONT'D

637.5	45	31	1	-41	26.0	174	49.0	14	12.3	998.8	2000	1	2	-41	58.0	168	7.0	236	3.5
640.6	100	31	1	-41	23.0	174	50.0	90	0.0	1000.6	2030	1	2	-41	59.0	168	5.0	246	4.8
640.6	102	31	1	-41	23.0	174	50.0	270	7.5	1003.1	2100	1	2	-42	0.0	168	2.0	246	4.8
641.3	108	31	1	-41	23.0	174	49.0	270	6.4	1007.9	2200	1	2	-42	2.0	167	56.0	246	4.8
642.1	115	31	1	-41	23.0	174	48.0	246	6.5	1012.8	2300	1	2	-42	4.0	167	50.0	249	5.5
647.0	200	31	1	-41	25.0	174	42.0	325	7.2	1018.4	0	2	2	-42	6.0	167	43.0	251	3.1
661.6	400	31	1	-41	13.0	174	31.0	356	10.0	1021.5	100	2	2	-42	7.0	167	39.0	236	5.3
671.6	500	31	1	-41	3.0	174	30.0	343	10.4	1026.9	200	2	2	-42	10.0	167	33.0	236	5.3
676.8	530	31	1	-40	58.0	174	28.0	323	10.0	1032.3	300	2	2	-42	13.0	167	27.0	246	4.8
681.8	600	31	1	-40	54.0	174	24.0	326	10.8	1037.1	400	2	2	-42	15.0	167	21.0	228	4.2
692.7	700	31	1	-40	45.0	174	16.0	329	11.6	1040.1	442	2	2	-42	17.0	167	18.0	270	7.3
698.5	730	31	1	-40	40.0	174	12.0	308	9.6	1040.9	448	2	2	-42	17.0	167	17.0	249	4.2
703.4	800	31	1	-40	37.0	174	7.0	309	7.8	1052.0	724	2	2	-42	21.0	167	3.0	259	4.7
711.2	900	31	1	-40	32.0	173	59.0	281	9.5	1057.2	830	2	2	-42	22.0	166	56.0	243	8.2
716.7	934	31	1	-40	31.0	173	52.0	285	9.0	1074.7	1037	2	2	-42	30.0	166	35.0	240	8.6
720.6	1000	31	1	-40	30.0	173	47.0	276	9.1	1086.6	1200	2	2	-42	36.0	166	21.0	242	9.6
729.8	1100	31	1	-40	29.0	173	35.0	270	6.0	1154.0	1900	2	2	-43	8.0	165	0.0	245	10.4
731.3	1115	31	1	-40	29.0	173	33.0	286	9.0	1175.0	2100	2	2	-43	17.0	164	34.0	245	8.5
745.6	1250	31	1	-40	25.0	173	15.0	270	9.1	1231.9	338	3	2	-43	41.0	163	23.0	216	10.5
747.1	1300	31	1	-40	25.0	173	13.0	270	9.6	1233.1	345	3	2	-43	42.0	163	22.0	244	8.1
776.0	1600	31	1	-40	25.0	172	35.0	259	10.8	1275.8	900	3	2	-44	1.0	162	29.0	241	8.2
786.9	1700	31	1	-40	27.0	172	21.0	249	11.3	1279.9	930	3	2	-44	3.0	162	24.0	231	9.0
798.2	1800	31	1	-40	31.0	172	7.0	245	11.7	1292.7	1055	3	2	-44	11.0	162	10.0	245	5.6
810.0	1900	31	1	-40	36.0	171	53.0	245	11.7	1295.1	1120	3	2	-44	12.0	162	7.0	245	14.2
833.5	2100	31	1	-40	46.0	171	25.0	249	11.3	1297.5	1130	3	2	-44	13.0	162	4.0	206	3.3
844.8	2200	31	1	-40	50.0	171	11.0	245	11.7	1304.1	1330	3	2	-44	19.0	162	0.0	180	2
856.5	2300	31	1	-40	55.0	170	57.0	241	10.3	1307.1	300	4	2	-44	22.0	162	0.0	180	5.3
866.8	0	1	2	-41	0.0	170	45.0	246	5.5	1311.1	345	4	2	-44	26.0	162	0.0	190	3.8
889.1	400	1	2	-41	9.0	170	18.0	242	8.0	1315.2	448	4	2	-44	30.0	161	59.0	180	4.9
921.4	800	1	2	-41	24.0	169	40.0	243	7.1	1316.2	500	4	2	-44	31.0	161	59.0	180	2.5
948.2	1145	1	2	-41	36.0	169	8.0	243	6.2	1318.2	548	4	2	-44	33.0	161	59.0	180	4.9
976.7	1620	1	2	-41	49.0	168	34.0	246	5.8	1319.2	600	4	2	-44	34.0	161	59.0	180	3.3
979.1	1645	1	2	-41	50.0	168	31.0	243	5.9	1321.2	636	4	2	-44	36.0	161	59.0	200	5.3
992.5	1900	1	2	-41	56.0	168	15.0	236	8.9	1323.3	700	4	2	-44	38.0	161	58.0	180	4.0
994.3	1912	1	2	-41	57.0	168	13.0	257	5.7	1327.3	800	4	2	-44	42.0	161	58.0	189	9.1

FLT. 16 NAVIGATION CONT'D

1336.4	900	4	2	-44	51.0	161	56.0	190	8.1	1606.1	25	7	2	-49	18.0	162	0.0	180	5.0
1340.5	930	4	2	-44	55.0	161	55.0	179	7.3	1637.1	630	7	2	-49	49.0	162	0.0	180	5.1
1386.5	1545	4	2	-45	41.0	161	56.0	180	8.0	1660.1	1100	7	2	-50	12.0	162	0.0	180	5.9
1396.5	1700	4	2	-45	51.0	161	56.0	175	8.0	1667.1	1210	7	2	-50	19.0	162	0.0	180	6.0
1412.5	1900	4	2	-46	7.0	161	58.0	180	8.0	1690.1	1600	7	2	-50	42.0	162	0.0	180	6.9
1424.5	2030	4	2	-46	19.0	161	58.0	180	8.0	1697.1	1700	7	2	-50	49.0	162	0.0	180	4.0
1428.5	2100	4	2	-46	23.0	161	58.0	176	9.0	1710.1	2015	7	2	-51	2.0	162	0.0	90	0.0
1437.6	2200	4	2	-46	32.0	161	59.0	180	11.0	1710.1	2055	7	2	-51	2.0	162	0.0	0	1.4
1448.6	2300	4	2	-46	43.0	161	59.0	180	10.0	1711.1	2136	7	2	-51	1.0	162	0.0	32	7.8
1453.6	2330	4	2	-46	48.0	161	59.0	180	11.2	1712.3	2145	7	2	-51	0.0	162	1.0	90	0.0
1459.6	2	5	2	-46	54.0	161	59.0	161	4.8	1712.3	2147	7	2	-51	0.0	162	1.0	180	1.3
1461.7	28	5	2	-46	56.0	162	0.0	90	0.0	1713.3	2233	7	2	-51	1.0	162	1.0	148	.8
1461.7	40	5	2	-46	56.0	162	0.0	134	3.4	1714.5	0	8	2	-51	2.0	162	2.0	90	1.8
1464.5	130	5	2	-46	58.0	162	3.0	180	6.0	1715.1	20	8	2	-51	2.0	162	3.0	180	6.0
1465.5	140	5	2	-46	59.0	162	3.0	138	3.6	1719.1	100	8	2	-51	6.0	162	3.0	203	1.6
1469.6	246	5	2	-47	2.0	162	7.0	146	5.1	1722.3	255	8	2	-51	9.0	162	1.0	180	.7
1470.8	300	5	2	-47	3.0	162	8.0	186	.7	1723.3	418	8	2	-51	10.0	162	1.0	180	11.4
1477.8	1255	5	2	-47	10.0	162	7.0	180	4.2	1772.3	835	8	2	-51	59.0	162	1.0	158	.6
1479.8	1323	5	2	-47	12.0	162	7.0	180	4.5	1775.6	1347	8	2	-52	2.0	162	3.0	275	10.0
1494.8	1642	5	2	-47	27.0	162	7.0	184	5.0	1808.9	1706	8	2	-51	59.0	161	9.0	276	9.4
1531.9	0	6	2	-48	4.0	162	3.0	193	2.6	1826.9	1900	8	2	-51	57.0	160	40.0	180	6.3
1535.0	110	6	2	-48	7.0	162	2.0	180	2.4	1842.9	2130	8	2	-52	13.0	160	40.0	180	6.0
1537.0	200	6	2	-48	9.0	162	2.0	90	0.0	1845.9	2200	8	2	-52	16.0	160	40.0	180	6.6
1537.0	205	6	2	-48	9.0	162	2.0	180	11.9	1846.9	2209	8	2	-52	17.0	160	40.0	231	3.9
1538.0	210	6	2	-48	10.0	162	2.0	193	3.6	1848.5	2233	8	2	-52	18.0	160	38.0	211	5.0
1541.1	300	6	2	-48	13.0	162	1.0	180	12.0	1852.0	2315	8	2	-52	21.0	160	35.0	211	2.0
1543.1	310	6	2	-48	15.0	162	1.0	180	5.9	1853.2	2350	8	2	-52	22.0	160	34.0	216	9.2
1544.1	320	6	2	-48	16.0	162	1.0	181	6.8	1859.4	30	9	2	-52	27.0	160	28.0	218	10.3
1577.1	810	6	2	-48	49.0	162	0.0	180	6.0	1872.1	144	9	2	-52	37.0	160	15.0	213	12.2
1579.1	830	6	2	-48	51.0	162	0.0	180	3.7	1887.7	300	9	2	-52	50.0	160	1.0	214	12.8
1588.1	1055	6	2	-49	0.0	162	0.0	90	0.0	1926.3	600	9	2	-53	22.0	159	25.0	175	12.7
1588.1	1100	6	2	-49	0.0	162	0.0	180	1.2	1945.4	730	9	2	-53	41.0	159	28.0	270	12.0
1604.1	2350	6	2	-49	16.0	162	0.0	180	5.9	1954.8	817	9	2	-53	41.0	159	12.0	180	6.4
1605.1	0	7	2	-49	17.0	162	0.0	90	0.0	1957.8	845	9	2	-53	44.0	159	12.0	180	6.0
1605.1	1	7	2	-49	17.0	162	0.0	180	2.5	1958.8	855	9	2	-53	45.0	159	12.0	180	1.2

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1959.8	944	9	2	-53	46.0	159	12.0	0	11.9	2071.1	1346	10	2	-54	31.0	159	4.0	180	8.5
1961.8	954	9	2	-53	44.0	159	12.0	211	.9	2073.1	1400	10	2	-54	33.0	159	4.0	180	10.9
1963.0	1110	9	2	-53	45.0	159	11.0	270	7.3	2077.1	1422	10	2	-54	37.0	159	4.0	196	10.8
1966.0	1134	9	2	-53	45.0	159	6.0	270	11.8	2081.3	1445	10	2	-54	41.0	159	2.0	148	12.5
1967.1	1140	9	2	-53	45.0	159	4.0	270	2.3	2109.6	1700	10	2	-55	5.0	159	28.0	150	10.9
1968.3	1210	9	2	-53	45.0	159	2.0	222	.6	2131.4	1900	10	2	-55	24.0	159	47.0	133	2.3
1971.0	1600	9	2	-53	47.0	158	59.0	97	9.7	2150.7	302	11	2	-55	37.0	160	12.0	228	3.1
1995.4	1830	9	2	-53	50.0	159	40.0	129	6.6	2152.2	331	11	2	-55	38.0	160	10.0	239	5.2
2008.2	2025	9	2	-53	58.0	159	57.0	240	2.6	2175.7	800	11	2	-55	50.0	159	34.0	228	5.3
2010.2	2111	9	2	-53	59.0	159	54.0	191	1.6	2177.2	817	11	2	-55	51.0	159	32.0	235	4.8
2013.3	2300	9	2	-54	2.0	159	53.0	191	2.0	2180.7	900	11	2	-55	53.0	159	27.0	236	5.3
2016.4	30	10	2	-54	5.0	159	52.0	221	10.4	2186.1	1000	11	2	-55	56.0	159	19.0	227	4.8
2040.3	247	10	2	-54	23.0	159	25.0	221	12.2	2200.7	1301	11	2	-56	6.0	159	0.0	29	4.7
2042.9	300	10	2	-54	25.0	159	22.0	247	13.0	2202.9	1330	11	2	-56	4.0	159	2.0	128	2.4
2050.5	335	10	2	-54	28.0	159	10.0	316	10.0	2207.9	1530	11	2	-56	7.0	159	9.0	239	2.7
2054.7	400	10	2	-54	25.0	159	5.0	311	9.2	2209.8	1612	11	2	-56	8.0	159	6.0	231	3.5
2056.3	410	10	2	-54	24.0	159	3.0	270	6.9	2216.2	1800	11	2	-56	12.0	158	57.0	232	4.9
2057.4	420	10	2	-54	24.0	159	1.0	90	0.0	2221.1	1900	11	2	-56	15.0	158	50.0	248	3.5
2057.4	423	10	2	-54	24.0	159	1.0	90	0.0	2237.3	2330	11	2	-56	21.0	158	23.0	43	4.9
2057.4	427	10	2	-54	24.0	159	1.0	90	0.0	2241.4	20	12	2	-56	18.0	158	28.0	90	1.9
2057.4	432	10	2	-54	24.0	159	1.0	210	1.7	2241.9	37	12	2	-56	18.0	158	29.0	180	2.4
2058.6	512	10	2	-54	25.0	159	0.0	90	0.0	2242.9	101	12	2	-56	19.0	158	29.0	180	1.9
2058.6	535	10	2	-54	25.0	159	0.0	139	1.7	2244.9	204	12	2	-56	21.0	158	29.0	270	.1
2061.2	708	10	2	-54	27.0	159	3.0	191	10.1	2245.5	525	12	2	-56	21.0	158	28.0	180	1.2
2064.3	726	10	2	-54	30.0	159	2.0	90	0.0	2247.5	700	12	2	-56	23.0	158	28.0	90	0.0
2064.3	728	10	2	-54	30.0	159	2.0	180	4.1	2247.5	712	12	2	-56	23.0	158	28.0	110	9.8
2066.3	757	10	2	-54	32.0	159	2.0	90	0.0	2250.4	730	12	2	-56	24.0	158	33.0	90	9.9
2066.3	820	10	2	-54	32.0	159	2.0	90	0.0	2253.7	750	12	2	-56	24.0	158	39.0	132	10.0
2066.3	845	10	2	-54	32.0	159	2.0	90	0.0	2295.8	1200	12	2	-56	52.0	159	36.0	131	10.8
2066.3	915	10	2	-54	32.0	159	2.0	90	0.0	2377.0	1930	12	2	-57	45.0	161	30.0	132	11.3
2066.3	925	10	2	-54	32.0	159	2.0	330	.9	2397.8	2120	12	2	-57	59.0	161	59.0	187	13.9
2067.4	1039	10	2	-54	31.0	159	1.0	90	0.0	2435.1	0	13	2	-58	36.0	161	50.0	179	11.7
2067.4	1106	10	2	-54	31.0	159	1.0	90	0.0	2459.1	203	13	2	-59	0.0	161	51.0	166	8.8
2067.4	1201	10	2	-54	31.0	159	1.0	330	4.9	2461.2	217	13	2	-59	2.0	161	52.0	226	.2
2068.6	1215	10	2	-54	30.0	159	0.0	113	1.6	2462.6	900	13	2	-59	3.0	161	50.0	252	.6

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2465.9	1355	13	2	-59	4.0	161	44.0	51	5.4	3029.2	2253	17	2	-52	38.0	166	37.0	90	0.0
2504.3	2100	13	2	-58	40.0	162	42.0	46	6.1	3029.2	2300	17	2	-52	38.0	166	37.0	329	4.6
2505.7	2114	13	2	-58	39.0	162	44.0	54	6.0	3030.4	2315	17	2	-52	37.0	166	36.0	351	8.0
2522.6	0	14	2	-58	29.0	163	10.0	38	5.0	3034.4	2345	17	2	-52	33.0	166	35.0	0	4.0
2527.7	100	14	2	-58	25.0	163	16.0	46	6.2	3035.4	0	18	2	-52	32.0	166	35.0	354	6.0
2529.1	114	14	2	-58	24.0	163	18.0	46	2.1	3041.5	100	18	2	-52	26.0	166	34.0	90	2.4
2530.6	155	14	2	-58	23.0	163	20.0	90	6.2	3042.7	130	18	2	-52	26.0	166	36.0	112	2.1
2531.1	200	14	2	-58	23.0	163	21.0	38	4.7	3045.3	245	18	2	-52	27.0	166	40.0	57	1.1
2533.6	232	14	2	-58	21.0	163	24.0	46	6.2	3049.0	600	18	2	-52	25.0	166	45.0	90	0.0
2536.5	300	14	2	-58	19.0	163	28.0	58	6.3	3049.0	618	18	2	-52	25.0	166	45.0	0	6.6
2542.1	353	14	2	-58	16.0	163	37.0	58	5.0	3052.0	645	18	2	-52	22.0	166	45.0	354	4.1
2544.0	415	14	2	-58	15.0	163	40.0	46	3.8	3064.0	940	18	2	-52	10.0	166	43.0	0	4.4
2546.9	500	14	2	-58	13.0	163	44.0	51	4.7	3066.0	1007	18	2	-52	8.0	166	43.0	351	6.3
2556.4	700	14	2	-58	7.0	163	58.0	90	2.6	3078.2	1201	18	2	-51	56.0	166	40.0	0	11.9
2557.0	712	14	2	-58	7.0	163	59.0	53	5.4	3079.2	1206	18	2	-51	55.0	166	40.0	168	6.1
2588.7	1300	14	2	-57	48.0	164	47.0	51	4.7	3082.2	1236	18	2	-51	58.0	166	41.0	180	6.6
2612.7	1800	14	2	-57	33.0	165	22.0	50	5.1	3083.2	1245	18	2	-51	59.0	166	41.0	62	1.5
2620.5	1930	14	2	-57	28.0	165	33.0	0	6.0	3085.3	1407	18	2	-51	58.0	166	44.0	0	2.8
2626.5	2030	14	2	-57	22.0	165	33.0	0	4.2	3086.3	1428	18	2	-51	57.0	166	44.0	2	7.5
2631.5	2140	14	2	-57	17.0	165	33.0	350	.9	3129.4	2010	18	2	-51	14.0	166	47.0	343	8.3
2634.5	50	15	2	-57	14.0	165	32.0	59	2.7	3131.5	2025	18	2	-51	12.0	166	46.0	356	8.0
2652.2	710	15	2	-57	5.0	166	0.0	52	2.1	3139.5	2125	18	2	-51	4.0	166	45.0	0	3.9
2657.0	925	15	2	-57	2.0	166	7.0	90	1.0	3140.5	2140	18	2	-51	3.0	166	45.0	348	6.1
2657.5	955	15	2	-57	2.0	166	8.0	29	4.8	3143.6	2210	18	2	-51	0.0	166	44.0	354	6.9
2658.7	1009	15	2	-57	1.0	166	9.0	66	10.2	3149.6	2302	18	2	-50	54.0	166	43.0	328	4.1
2683.7	1236	15	2	-56	51.0	166	51.0	66	9.7	3150.8	2319	18	2	-50	53.0	166	42.0	0	5.4
2786.5	2310	15	2	-56	9.0	169	41.0	40	1.4	3151.8	2330	18	2	-50	52.0	166	42.0	0	1.9
2789.1	100	16	2	-56	7.0	169	44.0	48	1.4	3152.8	0	19	2	-50	51.0	166	42.0	90	0.0
2790.6	200	16	2	-56	6.0	169	46.0	29	3.4	3152.8	3	19	2	-50	51.0	166	42.0	0	.9
2794.0	300	16	2	-56	3.0	169	49.0	314	4.7	3153.8	105	19	2	-50	50.0	166	42.0	288	10.8
2827.4	1000	16	2	-55	40.0	169	6.0	334	4.9	3163.7	200	19	2	-50	47.0	166	27.0	305	13.9
2845.2	1336	16	2	-55	24.0	168	52.0	335	4.7	3170.7	230	19	2	-50	43.0	166	18.0	140	2.3
2895.0	0	17	2	-54	39.0	168	15.0	335	5.6	3174.6	410	19	2	-50	46.0	166	22.0	148	2.8
2985.4	1600	17	2	-53	17.0	167	10.0	329	5.8	3175.8	435	19	2	-50	47.0	166	23.0	176	8.3
2991.3	1700	17	2	-53	12.0	167	5.0	334	6.4	3193.8	645	19	2	-51	5.0	166	25.0	270	4.5

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3195.7	710	19	2	-51	5.0	166	22.0	90	0.0	3560.0	200	21	2	-49	17.0	171	41.0	90	7.8
3195.7	718	19	2	-51	5.0	166	22.0	239	5.6	3560.7	205	21	2	-49	17.0	171	42.0	33	7.1
3201.6	820	19	2	-51	8.0	166	14.0	328	7.8	3561.9	215	21	2	-49	16.0	171	43.0	90	7.8
3202.8	829	19	2	-51	7.0	166	13.0	68	3.6	3562.5	220	21	2	-49	16.0	171	44.0	90	9.7
3205.5	913	19	2	-51	6.0	166	17.0	90	4.0	3563.9	228	21	2	-49	16.0	171	46.0	90	0.0
3208.6	1000	19	2	-51	6.0	166	22.0	118	2.7	3563.9	230	21	2	-49	16.0	171	46.0	90	4.5
3210.7	1046	19	2	-51	7.0	166	25.0	90	2.6	3569.1	339	21	2	-49	16.0	171	54.0	90	13.0
3211.4	1100	19	2	-51	7.0	166	26.0	90	7.5	3570.4	345	21	2	-49	16.0	171	56.0	90	8.5
3212.0	1105	19	2	-51	7.0	166	27.0	90	7.5	3578.2	440	21	2	-49	16.0	172	8.0	90	6.1
3212.6	1110	19	2	-51	7.0	166	28.0	168	4.5	3581.5	512	21	2	-49	16.0	172	13.0	0	9.9
3221.8	1310	19	2	-51	16.0	166	31.0	163	11.4	3582.5	518	21	2	-49	15.0	172	13.0	90	1.7
3223.9	1321	19	2	-51	18.0	166	32.0	180	3.9	3583.1	540	21	2	-49	15.0	172	14.0	0	6.0
3226.9	1407	19	2	-51	21.0	166	32.0	177	9.3	3585.1	600	21	2	-49	13.0	172	14.0	33	1.5
3281.0	1954	19	2	-52	15.0	166	36.0	61	4.1	3586.3	645	21	2	-49	12.0	172	15.0	90	7.8
3285.1	2055	19	2	-52	13.0	166	42.0	90	0.0	3587.0	650	21	2	-49	12.0	172	16.0	214	15.8
3285.1	2100	19	2	-52	13.0	166	42.0	0	11.0	3616.0	840	21	2	-49	36.0	171	51.0	330	12.3
3296.1	2200	19	2	-52	2.0	166	42.0	0	8.1	3635.6	1015	21	2	-49	19.0	171	36.0	152	13.6
3299.1	2222	19	2	-51	59.0	166	42.0	180	10.5	3642.4	1045	21	2	-49	25.0	171	41.0	0	14.4
3302.1	2239	19	2	-52	2.0	166	42.0	180	5.4	3648.4	1110	21	2	-49	19.0	171	41.0	249	8.3
3303.1	2250	19	2	-52	3.0	166	42.0	0	.8	3651.2	1130	21	2	-49	20.0	171	37.0	90	0.0
3304.1	0	20	2	-52	2.0	166	42.0	90	0.0	3651.2	1140	21	2	-49	20.0	171	37.0	327	2.8
3304.1	18	20	2	-52	2.0	166	42.0	32	8.8	3652.4	1205	21	2	-49	19.0	171	36.0	90	1.3
3307.7	42	20	2	-51	59.0	166	45.0	22	9.7	3653.0	1235	21	2	-49	19.0	171	37.0	90	3.5
3310.9	102	20	2	-51	56.0	166	47.0	28	8.0	3654.3	1257	21	2	-49	19.0	171	39.0	351	9.9
3326.8	300	20	2	-51	42.0	166	59.0	28	8.5	3764.6	0	22	2	-47	30.0	171	14.0	354	8.9
3343.8	500	20	2	-51	27.0	167	12.0	41	8.2	3845.0	900	22	2	-46	10.0	171	2.0	358	10.2
3350.4	548	20	2	-51	22.0	167	19.0	40	9.1	3863.0	1045	22	2	-45	52.0	171	1.0	348	8.1
3366.1	730	20	2	-51	10.0	167	35.0	59	10.8	3873.2	1200	22	2	-45	42.0	170	58.0	0	9.6
3396.9	1021	20	2	-50	54.0	168	17.0	52	11.3	3878.2	1231	22	2	-45	37.0	170	58.0	90	0.0
3403.4	1055	20	2	-50	50.0	168	25.0	57	10.6	3878.2	1233	22	2	-45	37.0	170	58.0	19	3.9
3468.3	1700	20	2	-50	15.0	169	51.0	54	10.2	3880.4	1305	22	2	-45	35.0	170	59.0	215	3.4
3488.8	1900	20	2	-50	3.0	170	17.0	49	9.8	3882.8	1348	22	2	-45	37.0	170	57.0	90	7.9
3508.5	2100	20	2	-49	50.0	170	40.0	50	10.9	3887.7	1425	22	2	-45	37.0	171	4.0	79	9.9
3530.4	2300	20	2	-49	36.0	171	6.0	48	10.4	3903.4	1600	22	2	-45	34.0	171	26.0	80	9.2
3540.9	0	21	2	-49	29.0	171	18.0	51	9.5	3959.0	2200	22	2	-45	24.0	172	44.0	83	8.4

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3967.5	2300	22	2	-45	23.0	172	56.0	70	8.9	4493.0	2100	25	2	-41	29.0	174	50.0	0	5.0
3970.4	2320	22	2	-45	22.0	173	0.0	90	0.0	4494.0	2112	25	2	-41	28.0	174	50.0	0	6.6
3970.4	2322	22	2	-45	22.0	173	0.0	90	5.2	4496.0	2130	25	2	-41	26.0	174	50.0	0	4.9
3971.1	2330	22	2	-45	22.0	173	1.0	90	4.2										
3971.8	2340	22	2	-45	22.0	173	2.0	70	8.9										
3974.8	0	23	2	-45	21.0	173	6.0	81	8.9										
4026.1	545	23	2	-45	13.0	174	18.0	80	9.1										
4037.6	700	23	2	-45	11.0	174	34.0	77	9.0										
4050.6	826	23	2	-45	8.0	174	52.0	90	7.6										
4052.0	837	23	2	-45	8.0	174	54.0	81	9.5										
4102.8	1355	23	2	-45	0.0	176	5.0	90	7.9										
4104.9	1411	23	2	-45	0.0	176	8.0	35	2.3										
4111.0	1645	23	2	-44	55.0	176	13.0	40	9.4										
4130.7	1850	23	2	-44	40.0	176	31.0	324	9.7										
4171.3	2300	23	2	-44	7.0	175	58.0	270	3.5										
4172.0	2312	23	2	-44	7.0	175	57.0	90	0.0										
4172.0	2322	23	2	-44	7.0	175	57.0	0	11.9										
4173.0	2327	23	2	-44	6.0	175	57.0	180	.9										
4175.0	130	24	2	-44	8.0	175	57.0	340	5.5										
4177.1	153	24	2	-44	6.0	175	56.0	333	8.9										
4218.6	630	24	2	-43	29.0	175	30.0	291	7.8										
4227.2	735	24	2	-43	26.0	175	19.0	283	6.7										
4231.6	815	24	2	-43	25.0	175	13.0	286	9.2										
4288.5	1426	24	2	-43	9.0	173	58.0	78	9.3										
4378.1	0	25	2	-42	51.0	175	58.0	77	10.0										
4382.6	27	25	2	-42	50.0	176	4.0	301	9.0										
4405.8	300	25	2	-42	38.0	175	37.0	304	5.3										
4409.4	340	25	2	-42	36.0	175	33.0	302	5.1										
4443.3	1015	25	2	-42	18.0	174	54.0	0	2.6										
4445.3	1100	25	2	-42	16.0	174	54.0	348	2.8										
4452.5	1330	25	2	-42	9.0	174	52.0	352	4.0										
4457.5	1445	25	2	-42	4.0	174	51.0	353	5.8										
4476.7	1800	25	2	-41	45.0	174	48.0	349	4.0										
4480.7	1900	25	2	-41	41.0	174	47.0	0	3.9										
4482.7	1930	25	2	-41	39.0	174	47.0	13	6.8										

ELTANIN 17 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS										
0.0	310	12	3	-41 26.0	174 49.0	134	13.7	1406.6	2200	17	3	-46	17.0	-154	33.0	145	5.6
								1407.8	2213	17	3	-46	18.0	-154	32.0	120	10.7
11.4	400	12	3	-41 34.0	175 0.0	129	11.5	1419.7	2320	17	3	-46	24.0	-154	17.0	125	10.9
21.0	450	12	3	-41 40.0	175 10.0	101	11.6	1454.3	230	18	3	-46	44.0	-153	36.0	126	4.2
81.0	1000	12	3	-41 51.0	176 29.0	100	5.9	1456.0	254	18	3	-46	45.0	-153	34.0	90	13.6
117.2	1606	12	3	-41 57.0	177 17.0	103	11.4	1456.7	257	18	3	-46	45.0	-153	33.0	138	5.4
121.8	1630	12	3	-41 58.0	177 23.0	90	9.2	1460.8	342	18	3	-46	48.0	-153	29.0	122	10.3
125.5	1654	12	3	-41 58.0	177 28.0	102	6.5	1530.6	1028	18	3	-47	25.0	-152	2.0	126	4.5
135.4	1824	12	3	-42 0.0	177 41.0	97	7.4	1532.3	1050	18	3	-47	26.0	-152	0.0	124	10.4
151.1	2030	12	3	-42 2.0	178 2.0	99	10.8	1580.9	1530	18	3	-47	53.0	-151	0.0	180	10.9
196.9	43	13	3	-42 9.0	179 3.0	96	9.2	1652.9	2205	18	3	-49	5.0	-151	0.0	180	2.4
206.6	146	13	3	-42 10.0	179 16.0	99	9.7	1653.9	2230	18	3	-49	6.0	-151	0.0	180	9.8
267.2	800	13	3	-42 19.0	-179 23.0	93	10.0	1722.9	530	19	3	-50	15.0	-151	0.0	91	10.3
418.1	2300	13	3	-42 28.0	-175 59.0	100	9.9	1765.1	935	19	3	-50	16.0	-149	54.0	90	5.4
448.1	200	14	3	-42 33.0	-175 19.0	102	10.5	1765.7	942	19	3	-50	16.0	-149	53.0	90	10.1
681.8	5	15	3	-43 23.0	-170 7.0	90	10.9	1779.8	1105	19	3	-50	16.0	-149	31.0	90	3.8
692.7	105	15	3	-43 23.0	-169 52.0	90	5.2	1781.0	1125	19	3	-50	16.0	-149	29.0	91	10.2
694.9	130	15	3	-43 23.0	-169 49.0	90	10.3	1864.8	1935	19	3	-50	18.0	-147	18.0	90	10.0
709.4	254	15	3	-43 23.0	-169 29.0	90	3.3	1899.3	2300	19	3	-50	18.0	-146	24.0	180	11.9
710.8	320	15	3	-43 23.0	-169 27.0	90	4.3	1900.3	2305	19	3	-50	19.0	-146	24.0	90	9.8
711.6	330	15	3	-43 23.0	-169 26.0	92	10.7	2030.5	1218	20	3	-50	19.0	-143	0.0	175	10.3
856.9	1700	15	3	-43 27.0	-166 6.0	94	10.4	2089.8	1800	20	3	-51	18.0	-142	52.0	176	11.0
930.3	0	16	3	-43 32.0	-164 25.0	93	10.8	2122.8	2100	20	3	-51	51.0	-142	48.0	180	9.4
1039.1	1000	16	3	-43 37.0	-161 55.0	97	8.0	2133.8	2210	20	3	-52	2.0	-142	48.0	153	8.9
11047.2	1100	16	3	-43 38.0	-161 44.0	87	10.6	2140.6	2255	20	3	-52	8.0	-142	43.0	95	9.5
11089.9	1500	16	3	-43 35.5	-160 45.0	83	8.0	2151.7	5	21	3	-52	9.0	-142	25.0	97	12.9
11098.0	1600	16	3	-43 34.5	-160 34.0	87	9.8	2160.3	45	21	3	-52	10.0	-142	11.0	90	6.1
11122.7	1830	16	3	-43 33.0	-160 0.0	125	10.3	2163.4	115	21	3	-52	10.0	-142	6.0	270	3.3
11335.6	1500	17	3	-45 34.0	-155 54.0	126	10.7	2164.0	126	21	3	-52	10.0	-142	7.0	270	1.9
11352.8	1636	17	3	-45 44.0	-155 34.0	126	4.2	2165.8	224	21	3	-52	10.0	-142	10.0	90	1.5
11354.6	1700	17	3	-45 45.0	-155 32.0	90	0.0	2168.3	400	21	3	-52	10.0	-142	6.0	90	4.2
11354.6	1703	17	3	-45 45.0	-155 32.0	134	6.4	2170.8	435	21	3	-52	10.0	-142	2.0	180	9.8
11357.5	1730	17	3	-45 47.0	-155 29.0	127	10.9	2197.8	720	21	3	-52	37.0	-142	2.0	180	5.9
11390.6	2032	17	3	-46 7.0	-154 51.0	126	12.8	2198.8	730	21	3	-52	38.0	-142	2.0	90	10.0
11392.3	2040	17	3	-46 8.0	-154 49.0	129	10.7	2258.8	1330	21	3	-52	38.0	-140	23.0	78	9.9

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2298.6	1730	21	3	-52	30.0	-139	19.0	90	10.8	3183.6	306	27	3	-56	49.0	-135	3.0	188	4.4
2456.2	800	22	3	-52	30.0	-135	0.0	180	5.2	3187.6	400	27	3	-56	53.0	-135	4.0	180	.5
2498.2	1600	22	3	-53	12.0	-135	0.0	180	7.9	3196.6	2103	27	3	-57	2.0	-135	4.0	189	9.3
2500.2	1615	22	3	-53	14.0	-135	0.0	180	8.0	3217.9	2320	27	3	-57	23.0	-135	10.0	181	9.0
2518.2	1830	22	3	-53	32.0	-135	0.0	180	5.2	3302.9	845	28	3	-58	48.0	-135	14.0	218	4.6
2525.2	1950	22	3	-53	39.0	-135	0.0	180	1.1	3313.0	1055	28	3	-58	56.0	-135	26.0	220	.4
2526.2	2040	22	3	-53	40.0	-135	0.0	17	2.5	3319.5	32	29	3	-59	1.0	-135	34.0	163	3.5
2528.3	2130	22	3	-53	38.0	-134	59.0	130	2.2	3324.7	200	29	3	-59	6.0	-135	31.0	163	7.0
2533.0	2335	22	3	-53	41.0	-134	53.0	109	2.9	3361.3	712	29	3	-59	41.0	-135	10.0	166	7.7
2536.1	38	23	3	-53	42.0	-134	48.0	93	10.1	3367.5	800	29	3	-59	47.0	-135	7.0	163	7.8
2638.0	1040	23	3	-53	48.0	-131	56.0	93	8.1	3383.2	1000	29	3	-60	2.0	-134	58.0	162	2.9
2738.4	2300	23	3	-53	54.0	-129	6.0	180	7.3	3386.3	1105	29	3	-60	5.0	-134	56.0	18	.7
2766.4	248	24	3	-54	22.0	-129	6.0	180	8.7	3389.5	1515	29	3	-60	2.0	-134	54.0	171	2.8
2818.4	845	24	3	-55	14.0	-129	6.0	274	7.1	3392.6	1618	29	3	-60	5.0	-134	53.0	166	7.9
2833.3	1050	24	3	-55	13.0	-129	32.0	273	6.3	3442.1	2230	29	3	-60	53.0	-134	28.0	154	2.2
2853.3	1400	24	3	-55	12.0	-130	7.0	270	6.8	3443.2	2300	29	3	-60	54.0	-134	27.0	26	1.1
2863.6	1530	24	3	-55	12.0	-130	25.0	270	6.7	3444.3	2400	29	3	-60	53.0	-134	26.0	167	1.2
2900.7	2100	24	3	-55	12.0	-131	30.0	0	9.0	3461.8	1400	30	3	-61	10.0	-134	18.0	109	.6
2924.7	2340	24	3	-54	48.0	-131	30.0	0	9.8	3464.8	1855	30	3	-61	11.0	-134	12.0	212	9.8
2942.7	130	25	3	-54	30.0	-131	30.0	256	10.0	3481.3	2035	30	3	-61	25.0	-134	30.0	224	6.6
3017.7	900	25	3	-54	48.0	-133	36.0	256	9.8	3484.0	2100	30	3	-61	27.0	-134	34.0	212	9.8
3064.5	1345	25	3	-54	59.0	-134	55.0	251	3.0	3516.0	15	31	3	-61	54.0	-135	10.0	215	2.7
3067.5	1445	25	3	-55	0.0	-135	0.0	90	0.0	3520.9	200	31	3	-61	58.0	-135	16.0	191	.4
3067.5	2100	25	3	-55	0.0	-135	0.0	180	1.9	3526.0	1430	31	3	-62	3.0	-135	18.0	19	1.3
3069.5	2200	25	3	-55	2.0	-135	0.0	180	3.8	3530.2	1745	31	3	-61	59.0	-135	15.0	180	3.2
3074.5	2318	25	3	-55	7.0	-135	0.0	180	3.6	3534.2	1900	31	3	-62	3.0	-135	15.0	180	9.7
3084.5	204	26	3	-55	17.0	-135	0.0	180	15.0	3556.2	2115	31	3	-62	25.0	-135	15.0	169	10.0
3085.5	208	26	3	-55	18.0	-135	0.0	180	2.6	3588.9	30	1	4	-62	57.0	-135	1.0	193	4.1
3087.5	254	26	3	-55	20.0	-135	0.0	180	5.0	3590.9	100	1	4	-62	59.0	-135	2.0	218	1.2
3089.5	318	26	3	-55	22.0	-135	0.0	186	11.9	3596.0	500	1	4	-63	3.0	-135	9.0	156	.5
3121.7	600	26	3	-55	54.0	-135	6.0	239	3.9	3598.2	900	1	4	-63	5.0	-135	7.0	61	.5
3123.7	630	26	3	-55	55.0	-135	9.0	270	3.8	3602.4	1642	1	4	-63	3.0	-134	59.0	177	5.4
3125.9	705	26	3	-55	55.0	-135	13.0	134	.7	3610.4	1810	1	4	-63	11.0	-134	58.0	177	9.2
3137.5	2150	26	3	-56	3.0	-134	58.0	184	8.7	3627.4	2000	1	4	-63	28.0	-134	56.0	188	8.6
3181.6	254	27	3	-56	47.0	-135	3.0	180	10.0	3647.6	2220	1	4	-63	48.0	-135	2.0	90	0.0

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3647.6	2230	1	4	-63	48.0	-135	2.0	188	4.7	4072.8	1520	7	4	-68	8.0	-130	21.0	90	2.8
3653.6	2347	1	4	-63	54.0	-135	4.0	192	3.2	4076.2	1630	7	4	-68	8.0	-130	12.0	87	10.1
3655.7	25	2	4	-63	56.0	-135	5.0	187	1.9	4121.7	2100	7	4	-68	6.0	-128	10.0	80	9.4
3662.7	400	2	4	-64	3.0	-135	7.0	103	.4	4145.2	2330	7	4	-68	2.0	-127	8.0	90	6.2
3667.2	1324	2	4	-64	4.0	-134	57.0	180	4.2	4147.8	2355	7	4	-68	2.0	-127	1.0	48	1.5
3671.2	1420	2	4	-64	8.0	-134	57.0	182	7.2	4149.3	55	8	4	-68	1.0	-126	58.0	143	.6
3683.2	1600	2	4	-64	20.0	-134	58.0	181	9.8	4158.0	1400	8	4	-68	8.0	-126	44.0	90	1.1
3720.2	1945	2	4	-64	57.0	-135	0.0	128	.2	4160.3	1600	8	4	-68	8.0	-126	38.0	86	10.9
3725.1	1403	3	4	-65	0.0	-134	51.0	180	3.7	4176.3	1728	8	4	-68	7.0	-125	55.0	68	10.2
3727.1	1435	3	4	-65	2.0	-134	51.0	184	10.1	4184.4	1815	8	4	-68	4.0	-125	35.0	30	10.2
3781.2	1955	3	4	-65	56.0	-134	59.0	186	3.6	4206.3	2023	8	4	-67	45.0	-125	6.0	114	11.4
3785.2	2102	3	4	-66	0.0	-135	0.0	96	.7	4208.8	2036	8	4	-67	46.0	-125	0.0	57	15.5
3795.0	1020	4	4	-66	1.0	-134	36.0	189	3.4	4210.6	2043	8	4	-67	45.0	-124	56.0	74	11.2
3811.2	1500	4	4	-66	17.0	-134	42.0	180	6.6	4214.1	2102	8	4	-67	44.0	-124	47.0	28	10.9
3813.2	1518	4	4	-66	19.0	-134	42.0	198	7.5	4219.8	2133	8	4	-67	39.0	-124	40.0	131	7.5
3818.4	1600	4	4	-66	24.0	-134	46.0	189	7.7	4221.3	2145	8	4	-67	40.0	-124	37.0	90	10.6
3847.8	1948	4	4	-66	53.0	-134	58.0	189	5.0	4224.0	2200	8	4	-67	40.0	-124	30.0	90	9.8
3852.9	2048	4	4	-66	58.0	-135	0.0	136	1.0	4233.8	2300	8	4	-67	40.0	-124	4.0	76	9.1
3869.7	1300	5	4	-67	10.0	-134	30.0	187	4.0	4246.0	20	9	4	-67	37.0	-123	33.0	311	9.1
3878.7	1515	5	4	-67	10.0	-134	33.0	206	8.8	4247.5	30	9	4	-67	36.0	-123	36.0	311	5.2
3883.2	1545	5	4	-67	23.0	-134	38.0	193	8.1	4250.6	105	9	4	-67	34.0	-123	42.0	302	10.3
3918.0	2000	5	4	-67	57.0	-134	58.0	231	1.9	4260.0	200	9	4	-67	29.0	-124	3.0	281	2.5
3927.6	100	6	4	-68	3.0	-135	18.0	312	3.0	4265.1	400	9	4	-67	28.0	-124	16.0	255	.7
3935.1	330	6	4	-67	58.0	-135	33.0	249	1.8	4272.6	1424	9	4	-67	30.0	-124	35.0	72	9.2
3937.9	500	6	4	-67	59.0	-135	40.0	163	.5	4275.9	1445	9	4	-67	29.0	-124	27.0	90	3.0
3943.1	1500	6	4	-68	4.0	-135	36.0	90	4.1	4277.4	1515	9	4	-67	29.0	-124	23.0	76	11.5
3948.4	1515	6	4	-68	4.0	-135	22.0	90	11.2	4311.0	1810	9	4	-67	21.0	-122	58.0	0	10.3
3957.7	1705	6	4	-68	4.0	-134	57.0	91	10.8	4316.0	1839	9	4	-67	16.0	-122	58.0	45	10.5
4021.9	2300	6	4	-68	5.0	-132	5.0	81	10.1	4351.3	2200	9	4	-66	51.0	-121	54.0	98	10.9
4047.3	130	7	4	-68	1.0	-130	58.0	103	3.2	4392.6	145	10	4	-66	57.0	-120	10.0	111	.3
4051.9	255	7	4	-68	2.0	-130	46.0	173	.7	4398.0	1840	10	4	-66	59.0	-119	57.0	90	8.7
4058.0	1129	7	4	-68	8.0	-130	44.0	251	3.6	4403.9	1920	10	4	-66	59.0	-119	42.0	91	11.5
4061.1	1220	7	4	-68	9.0	-130	52.0	71	4.7	4463.7	30	11	4	-67	0.0	-117	9.0	123	13.5
4064.2	1300	7	4	-68	8.0	-130	44.0	90	2.7	4484.1	200	11	4	-67	11.0	-116	25.0	100	5.8
4069.8	1500	7	4	-68	8.0	-130	29.0	90	8.9	4519.4	802	11	4	-67	17.0	-114	55.0	14	1.1

ELT. 17 NAVIGATION CONT'D

4525.6	1330	11	4	-67	11.0	-114	51.0	104	5.9	5118.5	0	17	4	-68	11.0	-95	3.0	8	2.0
4546.3	1700	11	4	-67	16.0	-113	59.0	106	9.9	5126.6	400	17	4	-68	3.0	-95	0.0	7	.4
4591.1	2130	11	4	-67	28.0	-112	7.0	129	10.8	5132.7	1850	17	4	-67	57.0	-94	58.0	21	3.7
4628.9	100	12	4	-67	52.0	-110	50.0	169	1.0	5133.7	1907	17	4	-67	56.0	-94	57.0	7	11.3
4631.0	300	12	4	-67	54.0	-110	49.0	252	.6	5189.1	0	18	4	-67	1.0	-94	40.0	18	3.1
4634.1	800	12	4	-67	55.0	-110	57.0	349	.5	5195.4	200	18	4	-66	55.0	-94	35.0	201	.2
4636.2	1200	12	4	-67	53.0	-110	58.0	99	2.0	5198.6	1530	18	4	-66	58.0	-94	38.0	11	3.0
4642.3	1500	12	4	-67	54.0	-110	42.0	137	1.8	5200.7	1610	18	4	-66	56.0	-94	37.0	8	10.0
4645.0	1630	12	4	-67	56.0	-110	37.0	92	12.1	5249.1	2100	18	4	-66	8.0	-94	21.0	348	.7
4675.5	1900	12	4	-67	57.0	-109	16.0	90	11.2	5260.4	1218	19	4	-65	57.0	-94	27.0	352	4.3
4732.1	3	13	4	-67	57.0	-106	45.0	180	.7	5263.4	1300	19	4	-65	54.0	-94	28.0	346	9.6
4741.1	1200	13	4	-68	6.0	-106	45.0	77	3.9	5326.2	1930	19	4	-64	53.0	-95	4.0	350	.5
4745.7	1310	13	4	-68	5.0	-106	33.0	82	9.6	5333.3	845	20	4	-64	46.0	-95	7.0	0	3.6
4821.3	2100	13	4	-67	55.0	-103	13.0	90	2.4	5336.3	935	20	4	-64	43.0	-95	7.0	6	4.9
4831.1	100	14	4	-67	55.0	-102	47.0	282	.4	5348.4	1200	20	4	-64	31.0	-95	4.0	8	6.0
4836.1	1220	14	4	-67	54.0	-103	0.0	90	3.4	5351.4	1230	20	4	-64	28.0	-95	3.0	5	10.0
4838.7	1306	14	4	-67	54.0	-102	53.0	90	7.1	5371.5	1430	20	4	-64	8.0	-94	59.0	176	.7
4841.0	1325	14	4	-67	54.0	-102	47.0	93	11.4	5383.5	725	21	4	-64	20.0	-94	57.0	11	3.8
4859.0	1500	14	4	-67	55.0	-101	59.0	94	9.9	5390.7	915	21	4	-64	13.0	-94	54.0	354	9.0
4925.3	2140	14	4	-68	0.0	-99	3.0	90	3.3	5470.1	1800	21	4	-62	54.0	-95	13.0	210	2.0
4926.4	2200	14	4	-68	0.0	-99	0.0	5	5.3	5478.2	2200	21	4	-63	1.0	-95	22.0	105	.4
4930.4	2245	14	4	-67	56.0	-98	59.0	108	.3	5482.0	600	22	4	-63	2.0	-95	14.0	50	.9
4933.6	700	15	4	-67	57.0	-98	51.0	339	.4	5486.7	1100	22	4	-62	59.0	-95	6.0	90	.1
4935.7	1145	15	4	-67	55.0	-98	53.0	129	16.4	5487.1	1415	22	4	-62	59.0	-95	5.0	13	2.7
4942.0	1208	15	4	-67	59.0	-98	40.0	124	6.2	5489.2	1500	22	4	-62	57.0	-95	4.0	10	10.3
4947.4	1300	15	4	-68	2.0	-98	28.0	127	10.6	5541.0	2000	22	4	-62	6.0	-94	44.0	13	4.1
4974.0	1530	15	4	-68	18.0	-97	31.0	160	4.2	5545.1	2100	22	4	-62	2.0	-94	42.0	148	1.7
4975.1	1545	15	4	-68	19.0	-97	30.0	127	11.5	5548.7	2300	22	4	-62	5.0	-94	38.0	155	1.1
5031.7	2040	15	4	-68	53.0	-95	26.0	0	5.9	5550.9	100	23	4	-62	7.0	-94	36.0	311	.7
5033.7	2100	15	4	-68	51.0	-95	26.0	0	6.0	5554.0	500	23	4	-62	5.0	-94	41.0	196	.9
5034.7	2110	15	4	-68	50.0	-95	26.0	342	5.7	5564.3	1623	23	4	-62	15.0	-94	47.0	352	7.3
5045.2	2300	15	4	-68	40.0	-95	35.0	336	1.4	5635.0	200	24	4	-61	5.0	-95	7.0	263	1.9
5049.6	200	16	4	-68	36.0	-95	40.0	159	1.3	5642.8	600	24	4	-61	6.0	-95	23.0	90	2.1
5072.0	1900	16	4	-68	57.0	-95	18.0	5	10.2	5651.5	1000	24	4	-61	6.0	-95	5.0	158	1.4
5113.2	2300	16	4	-68	16.0	-95	8.0	20	5.3	5663.3	1820	24	4	-61	17.0	-94	56.0	352	4.9

ELT. 17 NAVIGATION CONT'D

5670.4	1945	24	4	-61	10.0	-94	58.0	346	8.2	6189.5	2240	29	4	-56	4.0	-94	45.0	344	6.2
5676.5	2030	24	4	-61	4.0	-95	1.0	0	2.4	6191.6	2300	29	4	-56	2.0	-94	46.0	354	10.0
5677.5	2055	24	4	-61	3.0	-95	1.0	355	9.2	6206.7	30	30	4	-55	47.0	-94	49.0	350	4.9
5738.8	332	25	4	-60	2.0	-95	12.0	270	1.0	6216.8	232	30	4	-55	37.0	-94	52.0	354	10.0
5741.3	600	25	4	-60	2.0	-95	17.0	120	1.0	6226.9	332	30	4	-55	27.0	-94	54.0	0	10.0
5745.3	1000	25	4	-60	4.0	-95	10.0	188	2.3	6251.9	602	30	4	-55	2.0	-94	54.0	323	8.0
5752.4	1300	25	4	-60	11.0	-95	12.0	292	2.6	6255.6	630	30	4	-54	59.0	-94	58.0	114	.4
5755.1	1400	25	4	-60	10.0	-95	17.0	0	9.5	6260.6	1800	30	4	-55	1.0	-94	50.0	71	.7
5822.1	2100	25	4	-59	3.0	-95	17.0	0	3.0	6263.7	2200	30	4	-55	0.0	-94	45.0	43	3.7
5825.1	2200	25	4	-59	0.0	-95	17.0	174	.6	6270.5	2348	30	4	-54	55.0	-94	37.0	41	13.2
5830.1	600	26	4	-59	5.0	-95	16.0	327	3.1	6273.1	0	1	5	-54	53.0	-94	34.0	44	8.3
5839.6	900	26	4	-58	57.0	-95	26.0	281	1.5	6281.4	100	1	5	-54	47.0	-94	24.0	41	7.9
5844.8	1230	26	4	-58	56.0	-95	36.0	207	.9	6297.3	300	1	5	-54	35.0	-94	6.0	42	9.8
5846.0	1342	26	4	-58	57.0	-95	37.0	0	10.5	6326.9	600	1	5	-54	13.0	-93	32.0	43	7.8
5886.0	1730	26	4	-58	17.0	-95	37.0	156	10.9	6358.1	1000	1	5	-53	50.0	-92	56.0	43	8.9
5935.3	2200	26	4	-59	2.0	-94	58.0	359	8.0	6429.5	1800	1	5	-52	58.0	-91	34.0	43	10.1
5991.3	500	27	4	-58	6.0	-95	0.0	0	6.0	6480.2	2300	1	5	-52	21.0	-90	37.0	45	8.1
5997.3	600	27	4	-58	0.0	-95	0.0	332	3.3	6585.5	1200	2	5	-51	7.0	-88	36.0	37	10.0
6000.7	700	27	4	-57	57.0	-95	3.0	143	1.7	6877.4	1700	3	5	-47	15.0	-84	5.0	47	11.7
6009.5	1200	27	4	-58	4.0	-94	53.0	152	.4	6947.6	2300	3	5	-46	27.0	-82	50.0	41	10.7
6012.9	2000	27	4	-58	7.0	-94	50.0	342	8.4	7076.6	1100	4	5	-44	49.0	-80	50.0	45	9.9
6038.2	2300	27	4	-57	43.0	-95	5.0	344	8.7	7207.8	12	5	5	-43	17.0	-78	40.0	36	10.2
6060.0	130	28	4	-57	22.0	-95	16.0	0	10.0	7328.2	1200	5	5	-41	39.0	-77	5.0	26	10.0
6065.0	200	28	4	-57	17.0	-95	16.0	0	4.9	7383.7	1730	5	5	-40	49.0	-76	33.0	59	10.8
6085.0	600	28	4	-56	57.0	-95	16.0	118	1.4	7432.4	2200	5	5	-40	24.0	-75	38.0	39	9.8
6102.2	1800	28	4	-57	5.0	-94	48.0	29	.8	7493.8	415	6	5	-39	36.0	-74	48.0	91	8.9
6106.8	2320	28	4	-57	1.0	-94	44.0	70	3.7	7547.7	1015	6	5	-39	37.0	-73	38.0	0	6.6
6109.7	6	29	4	-57	0.0	-94	39.0	345	6.9	7562.7	1230	6	5	-39	22.0	-73	38.0	273	7.7
6111.8	24	29	4	-56	58.0	-94	40.0	350	9.9	7597.6	1700	6	5	-39	20.0	-74	23.0	270	7.7
6157.5	500	29	4	-56	13.0	-94	55.0	344	8.3	7624.7	2030	6	5	-39	20.0	-74	58.0	0	6.9
6161.7	530	29	4	-56	9.0	-94	57.0	350	10.1	7635.7	2205	6	5	-39	9.0	-74	58.0	92	7.8
6171.8	630	29	4	-55	59.0	-95	0.0	340	5.4	7696.2	545	7	5	-39	11.0	-73	40.0	153	13.5
6175.0	705	29	4	-55	56.0	-95	2.0	154	1.2	7699.6	600	7	5	-39	14.0	-73	38.0	180	6.4
6183.9	1400	29	4	-56	4.0	-94	55.0	90	.5	7706.6	705	7	5	-39	21.0	-73	38.0	159	5.1
6186.1	1800	29	4	-56	4.0	-94	51.0	90	.7	7708.7	730	7	5	-39	23.0	-73	37.0	72	6.4

ELTANIN 18 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS	2244.1	1030	9	6	-57	49.0	-99	26.0	344	.9
0.0	2330	25	5	-33 0.0	-71 40.0	242	5.3	2255.5	2218	9	6	-57	38.0	-99	32.0	185	6.8
50.4	900	26	5	-33 24.0	-72 33.0	243	7.3	2281.6	208	10	6	-58	4.0	-99	36.0	112	3.3
161.2	0	27	5	-34 14.0	-74 32.0	237	7.8	2294.7	600	10	6	-58	9.0	-99	13.0	28	.2
294.0	1700	27	5	-35 26.0	-76 48.0	241	7.9	2297.0	1400	10	6	-58	7.0	-99	11.0	332	.7
485.9	1700	28	5	-36 59.0	-80 16.0	241	6.2	2306.1	200	11	6	-57	59.0	-99	19.0	102	2.4
635.6	1700	29	5	-38 12.0	-83 1.0	242	8.7	2315.8	600	11	6	-58	1.0	-99	1.0	37	5.9
854.5	1800	30	5	-39 56.0	-87 9.0	240	8.7	2339.6	1000	11	6	-57	42.0	-98	34.0	38	9.1
1064.3	1800	31	5	-41 41.0	-91 9.0	240	8.3	2376.4	1400	11	6	-57	13.0	-97	52.0	47	11.4
11265.1	1800	1	6	-43 20.0	-95 6.0	239	11.8	2558.9	600	12	6	-55	8.0	-93	53.0	45	14.4
11282.8	1930	1	6	-43 29.0	-95 27.0	245	11.9	2732.1	1800	12	6	-53	5.0	-90	25.0	37	12.8
11339.5	15	2	6	-43 53.0	-96 38.0	246	11.5	3040.6	1800	13	6	-48	59.0	-85	29.0	36	12.1
11356.8	145	2	6	-44 0.0	-97 0.0	187	9.2	3320.7	1700	14	6	-45	11.0	-81	30.0	36	12.3
11562.3	0	3	6	-47 24.0	-97 35.0	188	7.6	3691.7	2300	15	6	-40	10.0	-76	35.0	35	12.6
11700.7	1800	3	6	-49 41.0	-98 5.0	190	8.3	3906.3	1600	16	6	-37	15.0	-73	56.0	35	12.4
11920.9	2015	4	6	-53 18.0	-99 5.0	180	8.5	3933.0	1809	16	6	-36	53.0	-73	37.0	54	12.8
11925.9	2050	4	6	-53 23.0	-99 5.0	180	8.3										
11968.9	200	5	6	-54 6.0	-99 5.0	180	6.2										
11993.9	600	5	6	-54 31.0	-99 5.0	180	4.0										
2001.9	800	5	6	-54 39.0	-99 5.0	206	1.5										
2009.7	1300	5	6	-54 46.0	-99 11.0	192	1.1										
2029.1	515	6	6	-55 5.0	-99 18.0	185	4.8										
2035.1	630	6	6	-55 11.0	-99 19.0	181	10.8										
2073.1	1000	6	6	-55 49.0	-99 20.0	191	.6										
2076.2	1500	6	6	-55 52.0	-99 21.0	185	1.0										
2082.2	2100	6	6	-55 58.0	-99 22.0	180	.2										
2083.2	100	7	6	-55 59.0	-99 22.0	169	.6										
2089.3	1000	7	6	-56 5.0	-99 20.0	48	.9										
2093.8	1430	7	6	-56 2.0	-99 14.0	191	9.0										
2153.0	2100	7	6	-57 0.0	-99 35.0	117	2.1										
2164.0	200	8	6	-57 5.0	-99 17.0	245	.5										
2166.4	600	8	6	-57 6.0	-99 21.0	335	.8										
2174.1	1500	8	6	-56 59.0	-99 27.0	352	1.1										
2182.2	2200	8	6	-56 51.0	-99 29.0	121	1.3										
2189.8	345	9	6	-56 55.0	-99 17.0	185	8.0										

ELTANIN 19 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS	1387.4	2200	11	7	-53	3.0	-95	28.0	222	7.0
0.0	1500	6	7	-36 41.0	-73 3.0	22	11.7	1392.8	2246	11	7	-53	7.0	-95	34.0	211	9.9
2.1	1511	6	7	-36 39.0	-73 2.0	0	9.6	1395.1	2300	11	7	-53	9.0	-95	36.0	230	8.2
6.1	1536	6	7	-36 35.0	-73 2.0	296	11.2	1399.8	2334	11	7	-53	12.0	-95	42.0	221	8.8
10.6	1600	6	7	-36 33.0	-73 7.0	234	12.1	1411.7	55	12	7	-53	21.0	-95	55.0	211	7.5
98.1	2313	6	7	-37 24.0	-74 36.0	227	11.1	1416.3	132	12	7	-53	25.0	-95	59.0	219	10.2
106.8	0	7	7	-37 30.0	-74 44.0	229	12.6	1482.3	800	12	7	-54	16.0	-97	10.0	213	10.0
144.7	300	7	7	-37 55.0	-75 20.0	228	12.3	1535.0	1315	12	7	-55	0.0	-98	0.0	196	9.9
305.6	1600	7	7	-39 43.0	-77 53.0	224	12.1	1539.1	1340	12	7	-55	4.0	-98	2.0	191	6.1
378.8	2200	7	7	-40 36.0	-78 59.0	223	11.0	1542.2	1410	12	7	-55	7.0	-98	3.0	196	11.0
389.8	2300	7	7	-40 44.0	-79 9.0	226	11.0	1573.4	1700	12	7	-55	37.0	-98	18.0	195	10.6
457.6	510	8	7	-41 31.0	-80 14.0	224	12.8	1703.1	510	13	7	-57	42.0	-99	21.0	195	6.2
498.2	820	8	7	-42 0.0	-80 52.0	228	8.9	1705.2	530	13	7	-57	44.0	-99	22.0	194	10.6
501.2	840	8	7	-42 2.0	-80 55.0	225	12.6	1755.8	1015	13	7	-58	33.0	-99	46.0	199	6.3
600.6	1630	8	7	-43 12.0	-82 31.0	216	9.2	1759.0	1045	13	7	-58	36.0	-99	48.0	195	2.0
601.9	1638	8	7	-43 13.0	-82 32.0	226	12.3	1773.4	1740	13	7	-58	50.0	-99	55.0	193	1.3
742.7	400	9	7	-44 50.0	-84 54.0	215	13.7	1793.9	920	14	7	-59	10.0	-100	4.0	181	9.2
750.1	432	9	7	-44 56.0	-85 0.0	223	8.8	1857.0	1610	14	7	-60	13.0	-100	7.0	180	8.7
754.2	500	9	7	-44 59.0	-85 4.0	219	14.3	1873.0	1800	14	7	-60	29.0	-100	7.0	180	5.2
771.0	610	9	7	-45 12.0	-85 19.0	221	11.5	1875.0	1823	14	7	-60	31.0	-100	7.0	201	.4
827.0	1100	9	7	-45 54.0	-86 12.0	218	7.6	1885.7	1833	15	7	-60	41.0	-100	15.0	176	9.1
837.2	1220	9	7	-46 2.0	-86 21.0	224	10.4	1899.7	2005	15	7	-60	55.0	-100	13.0	171	7.2
844.1	1300	9	7	-46 7.0	-86 28.0	219	10.4	1902.8	2030	15	7	-60	58.0	-100	12.0	160	11.4
1105.0	1400	10	7	-49 30.0	-90 32.0	220	11.1	1941.1	2350	15	7	-61	34.0	-99	45.0	155	4.4
1133.9	1635	10	7	-49 52.0	-91 1.0	220	10.5	1942.2	5	16	7	-61	35.0	-99	44.0	189	.2
1163.9	1925	10	7	-50 15.0	-91 31.0	213	7.1	1945.2	1310	16	7	-61	38.0	-99	45.0	215	6.5
1165.1	1935	10	7	-50 16.0	-91 32.0	222	10.0	1950.1	1355	16	7	-61	42.0	-99	51.0	231	1.2
1186.8	2145	10	7	-50 32.0	-91 55.0	212	7.1	1962.9	15	17	7	-61	50.0	-100	12.0	263	11.1
1188.0	2155	10	7	-50 33.0	-91 56.0	221	10.1	1987.1	225	17	7	-61	53.0	-101	3.0	223	5.4
1209.2	0	11	7	-50 49.0	-92 18.0	232	6.4	1988.5	240	17	7	-61	54.0	-101	5.0	263	9.9
1215.7	100	11	7	-50 53.0	-92 26.0	221	6.6	2027.8	637	17	7	-61	59.0	-102	28.0	337	4.7
1249.0	600	11	7	-51 18.0	-93 1.0	222	8.2	2046.2	1028	17	7	-61	42.0	-102	43.0	180	2.9
1295.8	1140	11	7	-51 53.0	-93 51.0	219	4.6	2060.2	1515	17	7	-61	56.0	-102	43.0	235	.3
1299.6	1230	11	7	-51 56.0	-93 55.0	221	9.3	2065.4	720	18	7	-61	59.0	-102	52.0	270	2.0
1309.0	1330	11	7	-52 3.0	-94 5.0	220	9.2	2069.7	925	18	7	-61	59.0	-103	1.0	270	2.8

ELT. 1° NAVIGATION CONT'D

2070.6	945	18	7	-61	59.0	-103	3.0	335	4.4	2433.0	800	23	7	-61	3.0	-109	44.0	136	.1
2071.7	1000	18	7	-61	58.0	-103	4.0	278	2.2	2434.4	1650	23	7	-61	4.0	-109	42.0	50	.4
2078.8	1306	18	7	-61	57.0	-103	19.0	270	9.1	2437.5	2335	23	7	-61	2.0	-109	37.0	334	6.6
2123.5	1800	18	7	-61	57.0	-104	54.0	270	4.0	2439.7	2355	23	7	-61	0.0	-109	39.0	348	9.7
2125.9	1835	18	7	-61	57.0	-104	59.0	205	.7	2463.3	220	24	7	-60	37.0	-109	49.0	351	5.2
2127.0	2000	18	7	-61	58.0	-105	0.0	270	4.5	2466.3	255	24	7	-60	34.0	-109	50.0	346	9.9
2142.0	2320	18	7	-61	58.0	-105	32.0	112	3.9	2504.4	645	24	7	-59	57.0	-110	8.0	351	6.0
2158.2	324	19	7	-62	4.0	-105	0.0	120	.4	2507.4	715	24	7	-59	54.0	-110	9.0	68	.3
2164.1	1610	19	7	-62	7.0	-104	49.0	270	4.6	2512.8	2110	24	7	-59	52.0	-109	59.0	72	.5
2173.5	1810	19	7	-62	7.0	-105	9.0	270	8.4	2516.0	323	25	7	-59	51.0	-109	53.0	346	5.6
2174.9	1820	19	7	-62	7.0	-105	12.0	270	12.6	2518.0	345	25	7	-59	49.0	-109	54.0	350	9.9
2183.3	1900	19	7	-62	7.0	-105	30.0	281	12.5	2572.8	915	25	7	-58	55.0	-110	12.0	333	3.8
2193.8	1950	19	7	-62	5.0	-105	52.0	270	5.8	2575.1	950	25	7	-58	53.0	-110	14.0	90	.7
2196.1	2014	19	7	-62	5.0	-105	57.0	281	13.6	2576.6	1150	25	7	-58	53.0	-110	11.0	105	.2
2206.6	2100	19	7	-62	3.0	-106	19.0	270	5.6	2580.4	35	26	7	-58	54.0	-110	4.0	175	2.1
2207.1	2105	19	7	-62	3.0	-106	20.0	277	12.8	2586.4	320	26	7	-59	0.0	-110	3.0	207	.4
2223.2	2220	19	7	-62	1.0	-106	54.0	270	18.7	2587.5	600	26	7	-59	1.0	-110	4.0	57	.4
2224.1	2223	19	7	-62	1.0	-106	56.0	283	11.6	2589.4	1015	26	7	-59	0.0	-110	1.0	354	6.7
2245.8	15	20	7	-61	56.0	-107	41.0	298	3.0	2594.4	1100	26	7	-58	55.0	-110	2.0	357	9.8
2248.0	57	20	7	-61	55.0	-107	45.0	317	6.3	2646.5	1616	26	7	-58	3.0	-110	8.0	47	5.6
2249.3	110	20	7	-61	54.0	-107	47.0	159	.2	2649.4	1647	26	7	-58	1.0	-110	4.0	90	.9
2254.7	2125	20	7	-61	59.0	-107	43.0	285	4.9	2650.4	1755	26	7	-58	1.0	-110	2.0	103	1.3
2262.5	2300	20	7	-61	57.0	-107	59.0	270	6.1	2654.8	2115	26	7	-58	2.0	-109	54.0	113	.9
2265.8	2332	20	7	-61	57.0	-108	6.0	266	9.3	2660.0	232	27	7	-58	4.0	-109	45.0	270	.1
2314.2	443	21	7	-62	0.0	-109	49.0	270	6.7	2660.5	545	27	7	-58	4.0	-109	46.0	227	.9
2316.6	504	21	7	-62	0.0	-109	54.0	212	3.7	2661.9	715	27	7	-58	5.0	-109	48.0	326	2.5
2320.1	600	21	7	-62	3.0	-109	58.0	113	.7	2675.2	1230	27	7	-57	54.0	-110	2.0	350	6.0
2325.2	1230	21	7	-62	5.0	-109	48.0	102	1.0	2678.3	1300	27	7	-57	51.0	-110	3.0	355	9.5
2348.7	1015	22	7	-62	10.0	-108	59.0	140	2.9	2713.4	1640	27	7	-57	16.0	-110	9.0	356	4.4
2355.2	1230	22	7	-62	15.0	-108	50.0	347	8.2	2720.4	1815	27	7	-57	9.0	-110	10.0	270	1.0
2359.3	1300	22	7	-62	11.0	-108	52.0	340	9.5	2721.0	1845	27	7	-57	9.0	-110	11.0	84	.5
2368.9	1400	22	7	-62	2.0	-108	59.0	339	9.6	2730.3	1145	28	7	-57	8.0	-109	54.0	20	6.3
2375.3	1440	22	7	-61	56.0	-109	4.0	343	7.9	2733.4	1215	28	7	-57	5.0	-109	52.0	15	10.8
2424.6	2050	22	7	-61	9.0	-109	35.0	338	5.5	2748.0	1335	28	7	-56	51.0	-109	45.0	15	6.2
2431.1	2200	22	7	-61	3.0	-109	40.0	270	.1	2750.0	1355	28	7	-56	49.0	-109	44.0	19	13.7

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2764.9	1500	28	7	-56	35.0	-109	35.0	334	10.2	3620.2	1300	3	8	-49	51.0	-124	18.0	292	9.9
2801.6	1835	28	7	-56	2.0	-110	4.0	344	8.3	3678.3	1850	3	8	-49	29.0	-125	41.0	270	7.7
2803.7	1850	28	7	-56	0.0	-110	5.0	116	1.4	3678.9	1855	3	8	-49	29.0	-125	42.0	293	9.7
2840.2	2035	29	7	-56	16.0	-109	6.0	323	8.9	3747.7	200	4	8	-49	2.0	-127	19.0	291	6.3
2844.0	2100	29	7	-56	13.0	-109	10.0	333	11.9	3753.3	253	4	8	-49	0.0	-127	27.0	297	7.7
2925.0	348	30	7	-55	1.0	-110	16.0	330	5.8	3755.5	310	4	8	-48	59.0	-127	30.0	287	5.8
2929.6	435	30	7	-54	57.0	-110	20.0	148	.9	3759.0	345	4	8	-48	58.0	-127	35.0	291	5.6
2944.9	2100	30	7	-55	10.0	-110	6.0	248	3.4	3761.8	415	4	8	-48	57.0	-127	39.0	294	6.6
2952.9	2320	30	7	-55	13.0	-110	19.0	11	7.3	3846.8	1700	4	8	-48	23.0	-129	37.0	299	10.6
2956.0	2345	30	7	-55	10.0	-110	18.0	5	9.5	3919.3	2350	4	8	-47	48.0	-131	12.0	303	9.5
3025.2	700	31	7	-54	1.0	-110	8.0	293	10.2	3979.2	608	5	8	-47	15.0	-132	26.0	326	4.5
3030.3	730	31	7	-53	59.0	-110	16.0	292	2.8	3980.4	624	5	8	-47	14.0	-132	27.0	270	.5
3041.1	1120	31	7	-53	55.0	-110	33.0	270	2.6	3981.1	740	5	8	-47	14.0	-132	28.0	303	3.2
3042.9	1200	31	7	-53	55.0	-110	36.0	295	2.8	3999.6	1325	5	8	-47	4.0	-132	51.0	111	.6
3059.7	1800	31	7	-53	48.0	-111	2.0	270	2.3	4010.6	646	6	8	-47	8.0	-132	36.0	180	.4
3060.9	1830	31	7	-53	48.0	-111	4.0	298	5.0	4011.6	905	6	8	-47	9.0	-132	36.0	244	6.8
3086.4	2330	31	7	-53	36.0	-111	42.0	270	2.9	4013.9	925	6	8	-47	10.0	-132	39.0	260	12.2
3087.0	2342	31	7	-53	36.0	-111	43.0	298	9.2	4217.3	200	7	8	-47	47.0	-137	35.0	260	10.0
3240.4	1615	1	8	-52	25.0	-115	29.0	295	4.3	4311.3	1120	7	8	-48	4.0	-139	53.0	270	6.9
3245.1	1720	1	8	-52	23.0	-115	36.0	347	2.2	4314.0	1143	7	8	-48	4.0	-139	57.0	263	9.2
3253.3	2100	1	8	-52	15.0	-115	39.0	51	1.2	4322.8	1240	7	8	-48	5.0	-140	10.0	178	9.7
3254.9	2215	1	8	-52	14.0	-115	37.0	43	2.5	4446.8	125	8	8	-50	9.0	-140	3.0	180	5.9
3260.3	22	2	8	-52	10.0	-115	31.0	270	2.0	4447.8	135	8	8	-50	10.0	-140	3.0	173	8.6
3261.0	40	2	8	-52	10.0	-115	32.0	290	10.2	4452.9	210	8	8	-50	15.0	-140	2.0	180	11.9
3418.6	1600	2	8	-51	16.0	-119	31.0	296	10.2	4453.9	215	8	8	-50	16.0	-140	2.0	182	9.7
3436.7	1746	2	8	-51	8.0	-119	57.0	328	8.8	4470.9	400	8	8	-50	33.0	-140	3.0	130	6.6
3437.9	1754	2	8	-51	7.0	-119	58.0	292	11.5	4472.9	418	8	8	-50	35.0	-140	3.0	180	14.1
3446.0	1836	2	8	-51	4.0	-120	10.0	328	8.8	4476.9	435	8	8	-50	39.0	-140	3.0	90	0.0
3447.2	1844	2	8	-51	3.0	-120	11.0	295	10.2	4476.9	439	8	8	-50	39.0	-140	3.0	182	9.9
3480.5	2200	2	8	-50	49.0	-120	59.0	295	7.0	4534.9	1030	8	8	-51	37.0	-140	6.0	187	6.7
3494.5	0	3	8	-50	43.0	-121	19.0	289	7.2	4540.0	1115	8	8	-51	42.0	-140	7.0	182	10.8
3500.6	50	3	8	-50	41.0	-121	28.0	294	10.0	4587.0	1535	8	8	-52	29.0	-140	10.0	178	9.3
3529.8	345	3	8	-50	29.0	-122	10.0	298	7.3	4615.0	1835	8	8	-52	57.0	-140	8.0	180	4.7
3534.1	420	3	8	-50	27.0	-122	16.0	295	10.0	4617.0	1900	8	8	-52	59.0	-140	8.0	182	8.3
3614.7	1220	3	8	-49	53.0	-124	10.0	291	8.2	4681.1	240	9	8	-54	3.0	-140	12.0	180	7.9

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4683.1	255	9	8	-54	5.0	-140	12.0	181	9.5	5084.5	2125	14	8	-59	47.0	-139	46.0	207	1.4
4718.1	636	9	8	-54	40.0	-140	13.0	191	7.6	5086.8	2300	14	8	-59	49.0	-139	48.0	162	2.8
4721.1	700	9	8	-54	43.0	-140	14.0	164	2.6	5096.3	220	15	8	-59	58.0	-139	42.0	90	0.0
4731.5	1100	9	8	-54	53.0	-140	9.0	150	.9	5096.3	240	15	8	-59	58.0	-139	42.0	41	3.3
4746.5	220	10	8	-55	6.0	-139	56.0	180	2.5	5101.6	415	15	8	-59	54.0	-139	35.0	105	1.0
4750.5	355	10	8	-55	10.0	-139	56.0	210	3.4	5117.1	1850	15	8	-59	58.0	-139	5.0	231	9.6
4751.7	415	10	8	-55	11.0	-139	57.0	189	9.1	5120.3	1910	15	8	-60	0.0	-139	10.0	216	9.3
4797.3	915	10	8	-55	56.0	-140	10.0	209	3.4	5179.5	130	16	8	-60	48.0	-140	20.0	224	5.5
4798.4	935	10	8	-55	57.0	-140	11.0	209	.3	5182.3	200	16	8	-60	50.0	-140	24.0	206	2.6
4803.0	2220	10	8	-56	1.0	-140	15.0	180	5.0	5191.2	520	16	8	-60	58.0	-140	32.0	90	0.0
4856.0	853	11	8	-56	54.0	-140	15.0	180	2.9	5191.2	545	16	8	-60	58.0	-140	32.0	206	2.7
4857.0	913	11	8	-56	55.0	-140	15.0	145	1.0	5196.7	745	16	8	-61	3.0	-140	37.0	134	.6
4865.6	1700	11	8	-57	2.0	-140	6.0	287	.9	5206.8	2330	16	8	-61	10.0	-140	22.0	180	6.0
4869.0	2046	11	8	-57	1.0	-140	12.0	138	1.8	5207.8	2340	16	8	-61	11.0	-140	22.0	181	9.6
4873.0	2300	11	8	-57	4.0	-140	7.0	331	2.6	5244.8	330	17	8	-61	48.0	-140	23.0	180	6.0
4878.7	110	12	8	-56	59.0	-140	12.0	168	.4	5247.8	400	17	8	-61	51.0	-140	23.0	123	2.8
4883.8	1130	12	8	-57	4.0	-140	10.0	180	6.0	5262.4	910	17	8	-61	59.0	-139	57.0	164	.3
4884.8	1140	12	8	-57	5.0	-140	10.0	170	8.9	5267.6	125	18	8	-62	4.0	-139	54.0	270	3.1
4936.5	1728	12	8	-57	56.0	-139	54.0	172	5.5	5268.1	134	18	8	-62	4.0	-139	55.0	296	5.5
4940.6	1812	12	8	-58	0.0	-139	53.0	227	.3	5316.3	1015	18	8	-61	43.0	-141	27.0	301	5.1
4942.0	2200	12	8	-58	1.0	-139	55.0	180	3.0	5320.1	1100	18	8	-61	41.0	-141	34.0	314	6.6
4952.0	120	13	8	-58	11.0	-139	55.0	90	0.0	5373.1	1900	18	8	-61	4.0	-142	53.0	316	4.9
4952.0	200	13	8	-58	11.0	-139	55.0	6	3.0	5374.5	1917	18	8	-61	3.0	-142	55.0	101	1.4
4957.1	340	13	8	-58	6.0	-139	54.0	208	1.0	5384.8	223	19	8	-61	5.0	-142	34.0	257	4.0
4969.5	1500	13	8	-58	17.0	-140	5.0	180	10.0	5393.7	435	19	8	-61	7.0	-142	52.0	106	.6
4972.5	1518	13	8	-58	20.0	-140	5.0	169	9.3	5397.3	1000	19	8	-61	8.0	-142	45.0	310	9.4
5009.1	1913	13	8	-58	56.0	-139	52.0	180	6.6	5400.4	1020	19	8	-61	6.0	-142	50.0	307	8.7
5012.1	1940	13	8	-58	59.0	-139	52.0	221	1.0	5443.6	1515	19	8	-60	40.0	-144	1.0	316	4.8
5016.1	2324	13	8	-59	2.0	-139	57.0	239	2.9	5446.4	1550	19	8	-60	38.0	-144	5.0	305	8.9
5025.7	240	14	8	-59	7.0	-140	13.0	90	0.0	5476.4	1910	19	8	-60	21.0	-144	55.0	315	5.6
5025.7	300	14	8	-59	7.0	-140	13.0	52	3.2	5477.8	1925	19	8	-60	20.0	-144	57.0	304	9.4
5032.2	500	14	8	-59	3.0	-140	3.0	90	.7	5497.5	2130	19	8	-60	9.0	-145	30.0	315	6.5
5040.4	1625	14	8	-59	3.0	-139	47.0	194	6.1	5498.9	2143	19	8	-60	8.0	-145	32.0	90	1.2
5042.5	1645	14	8	-59	5.0	-139	48.0	179	9.4	5506.9	400	20	8	-60	8.0	-145	16.0	305	6.0
5082.5	2100	14	8	-59	45.0	-139	46.0	180	4.7	5519.1	600	20	8	-60	1.0	-145	36.0	270	2.9

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5519.6	610	20	8	-60	1.0	-145	37.0	308	6.3	6077.5	1155	25	8	-54	28.0	-156	34.0	229	9.1
5543.8	1000	20	8	-59	46.0	-146	15.0	308	8.1	6079.0	1205	25	8	-54	29.0	-156	36.0	324	9.8
5610.3	1807	20	8	-59	5.0	-147	58.0	270	1.3	6111.0	1520	25	8	-54	3.0	-157	8.0	337	11.3
5610.9	1830	20	8	-59	5.0	-147	59.0	180	.5	6118.6	1600	25	8	-53	56.0	-157	13.0	303	10.6
5612.9	2210	20	8	-59	7.0	-147	59.0	43	1.3	6139.0	1755	25	8	-53	45.0	-157	42.0	304	10.4
5619.7	320	21	8	-59	2.0	-147	50.0	69	.2	6162.0	2007	25	8	-53	32.0	-158	14.0	310	5.1
5622.4	1535	21	8	-59	1.0	-147	45.0	303	4.4	6163.5	2025	25	8	-53	31.0	-158	16.0	301	10.6
5624.3	1600	21	8	-59	0.0	-147	48.0	317	7.9	6175.3	2131	25	8	-53	25.0	-158	33.0	304	6.3
5695.4	100	22	8	-58	8.0	-149	21.0	317	8.4	6178.9	2205	25	8	53	23.0	-158	38.0	302	9.0
5721.6	405	22	8	-57	49.0	-149	55.0	313	5.8	6190.1	2320	25	8	-53	17.0	-158	54.0	299	10.2
5723.0	420	22	8	-57	48.0	-149	57.0	28	2.2	6192.2	2332	25	8	-53	16.0	-158	57.0	309	9.6
5735.5	1000	22	8	-57	37.0	-149	46.0	290	.9	6225.5	300	26	8	-52	55.0	-159	40.0	270	6.0
5747.4	2230	22	8	-57	33.0	-150	7.0	332	6.8	6226.7	312	26	8	-52	55.0	-159	42.0	311	10.6
5748.6	2240	22	8	-57	32.0	-150	8.0	305	7.5	6238.8	420	26	8	-52	47.0	-159	57.0	301	9.8
5784.9	330	23	8	-57	11.0	-151	3.0	285	10.7	6258.5	620	26	8	-52	37.0	-160	25.0	90	0.0
5800.1	455	23	8	-57	7.0	-151	30.0	270	4.3	6258.5	627	26	8	-52	37.0	-160	25.0	300	9.9
5801.2	510	23	8	-57	7.0	-151	32.0	313	8.8	6373.6	1800	26	8	-51	39.0	-163	7.0	310	9.9
5802.7	520	23	8	-57	6.0	-151	34.0	270	9.7	6395.5	2012	26	8	-51	25.0	-163	34.0	317	9.1
5804.3	530	23	8	-57	6.0	-151	37.0	291	9.3	6398.2	2030	26	8	-51	23.0	-163	37.0	314	10.3
5818.3	700	23	8	-57	1.0	-152	1.0	270	3.2	6402.5	2055	26	8	-51	20.0	-163	42.0	298	14.1
5819.4	720	23	8	-57	1.0	-152	3.0	270	.2	6404.6	2104	26	8	-51	19.0	-163	45.0	310	9.9
5821.5	1600	23	8	-57	1.0	-152	7.0	314	6.6	6443.8	100	27	8	-50	54.0	-164	33.0	310	9.8
5836.0	1810	23	8	-56	51.0	-152	26.0	331	4.2	6519.6	840	27	8	-50	5.0	-166	4.0	308	8.1
5837.1	1826	23	8	-56	50.0	-152	27.0	314	7.2	6521.3	852	27	8	-50	4.0	-166	6.0	327	8.9
5854.5	2050	23	8	-56	38.0	-152	50.0	306	4.7	6523.7	908	27	8	-50	2.0	-166	8.0	270	4.2
5857.9	2133	23	8	-56	36.0	-152	55.0	312	7.8	6524.3	917	27	8	-50	2.0	-166	9.0	310	7.7
5896.7	230	24	8	-56	10.0	-153	47.0	320	6.2	6592.2	1800	27	8	-49	18.0	-167	29.0	303	9.3
5899.3	255	24	8	-56	8.0	-153	50.0	288	3.6	6618.0	2045	27	8	-49	4.0	-168	2.0	327	7.9
5905.8	440	24	8	-56	6.0	-154	1.0	6	6.0	6619.2	2054	27	8	-49	3.0	-168	3.0	291	10.5
5910.8	530	24	8	-56	1.0	-154	0.0	221	2.7	6622.0	2110	27	8	-49	2.0	-168	7.0	270	4.9
5922.7	946	24	8	-56	10.0	-154	14.0	142	1.1	6622.6	2118	27	8	-49	2.0	-168	8.0	303	9.7
5935.4	2100	24	8	-56	20.0	-154	0.0	317	4.9	6697.5	500	28	8	-48	21.0	-169	43.0	306	10.0
5939.5	2150	24	8	-56	17.0	-154	5.0	322	9.8	6747.0	955	28	8	-47	52.0	-170	43.0	270	4.0
6027.1	643	25	8	-55	8.0	-155	41.0	330	9.8	6747.7	1005	28	8	-47	52.0	-170	44.0	301	12.3
6028.3	650	25	8	-55	7.0	-155	42.0	322	9.6	6751.6	1024	28	8	-47	50.0	-170	49.0	270	5.7

ELTANIN 20 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS	602.0	400	17	9	-39	12.0	-172	5.0	90	5.8
0.0	913	14	9	-36 27.0	175 43.0	107	7.7	602.8	408	17	9	-39	12.0	-172	4.0	106	9.2
3.3	939	14	9	-36 28.0	175 47.0	90	8.0	720.0	1644	17	9	-39	44.0	-169	38.0	117	7.2
4.1	945	14	9	-36 28.0	175 48.0	102	9.0	724.3	1720	17	9	-39	46.0	-169	33.0	104	9.2
14.0	1050	14	9	-36 30.0	176 0.0	108	9.3	748.9	2000	17	9	-39	52.0	-169	2.0	106	8.7
68.8	1641	14	9	-36 47.0	177 5.0	113	10.4	784.8	5	18	9	-40	2.0	-168	17.0	101	5.9
71.4	1656	14	9	-36 48.0	177 8.0	90	10.6	790.2	100	18	9	-40	3.0	-168	10.0	105	9.4
73.0	1705	14	9	-36 48.0	177 10.0	107	10.5	802.1	215	18	9	-40	6.0	-167	55.0	105	7.1
79.7	1743	14	9	-36 50.0	177 18.0	109	10.3	806.0	248	18	9	-40	7.0	-167	50.0	123	9.1
89.0	1837	14	9	-36 53.0	177 29.0	90	10.6	807.9	300	18	9	-40	8.0	-167	48.0	90	4.5
90.6	1846	14	9	-36 53.0	177 31.0	106	10.2	808.6	310	18	9	-40	8.0	-167	47.0	106	9.6
116.4	2116	14	9	-37 0.0	178 2.0	122	6.6	823.0	439	18	9	-40	12.0	-167	29.0	110	6.7
118.3	2133	14	9	-37 1.0	178 4.0	107	10.1	831.9	558	18	9	-40	15.0	-167	18.0	108	9.3
135.0	2312	14	9	-37 6.0	178 24.0	90	5.9	841.5	700	18	9	-40	18.0	-167	6.0	90	6.3
135.8	2320	14	9	-37 6.0	178 25.0	103	9.8	844.6	729	18	9	-40	18.0	-167	2.0	114	7.8
148.9	40	15	9	-37 9.0	178 41.0	90	9.5	847.1	748	18	9	-40	19.0	-166	59.0	90	6.5
149.7	45	15	9	-37 9.0	178 42.0	107	13.3	847.8	755	18	9	-40	19.0	-166	58.0	108	10.5
153.0	100	15	9	-37 10.0	178 46.0	122	11.2	857.5	850	18	9	-40	22.0	-166	46.0	114	9.9
154.9	110	15	9	-37 11.0	178 48.0	105	8.3	859.9	905	18	9	-40	23.0	-166	43.0	106	9.1
185.4	448	15	9	-37 19.0	179 25.0	113	7.3	1050.8	553	19	9	-41	17.0	-162	41.0	103	5.6
190.6	530	15	9	-37 21.0	179 31.0	107	9.7	1055.5	642	19	9	-41	18.0	-162	35.0	108	9.0
301.0	1650	15	9	-37 54.0	-178 16.0	104	6.1	1103.6	1200	19	9	-41	33.0	-161	34.0	105	7.7
305.1	1730	15	9	-37 55.0	-178 11.0	102	9.2	1107.5	1230	19	9	-41	34.0	-161	29.0	109	8.5
323.6	1930	15	9	-37 59.0	-177 48.0	104	9.2	1128.8	1500	19	9	-41	41.0	-161	2.0	90	8.9
407.1	430	16	9	-38 19.0	-176 5.0	106	8.0	1130.3	1510	19	9	-41	41.0	-161	0.0	106	9.2
414.4	525	16	9	-38 21.0	-175 56.0	102	8.2	1190.9	2143	19	9	-41	58.0	-159	42.0	124	6.3
419.2	600	16	9	-38 22.0	-175 50.0	90	0.0	1192.7	2200	19	9	-41	59.0	-159	40.0	106	9.8
419.2	618	16	9	-38 22.0	-175 50.0	142	10.8	1229.0	140	20	9	-42	9.0	-158	53.0	114	7.3
420.5	625	16	9	-38 23.0	-175 49.0	90	8.5	1231.4	200	20	9	-42	10.0	-158	50.0	106	9.5
422.1	636	16	9	-38 23.0	-175 47.0	104	9.0	1253.0	415	20	9	-42	16.0	-158	22.0	103	6.8
476.8	1240	16	9	-38 36.0	-174 39.0	106	7.3	1257.6	455	20	9	-42	17.0	-158	16.0	104	9.6
484.2	1340	16	9	-38 38.0	-174 30.0	106	9.6	1273.6	635	20	9	-42	21.0	-157	55.0	109	7.4
523.9	1747	16	9	-38 49.0	-173 41.0	108	6.9	1279.8	725	20	9	-42	23.0	-157	47.0	106	9.0
570.4	27	17	9	-39 3.0	-172 44.0	90	7.7	1290.6	836	20	9	-42	26.0	-157	33.0	90	7.3
571.2	33	17	9	-39 3.0	-172 43.0	107	8.9	1291.3	842	20	9	-42	26.0	-157	32.0	105	9.6

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1311.1	1045	20	9	-42	31.0	-157	6.0	109	5.8	1997.0	40	25	9	-47	5.0	-144	53.0	190	10.6
1314.3	1117	20	9	-42	32.0	-157	2.0	107	9.3	2032.5	400	25	9	-47	40.0	-145	2.0	179	10.6
1377.2	1800	20	9	-42	50.0	-155	40.0	90	7.3	2070.5	735	25	9	-48	18.0	-145	1.0	179	10.2
1378.6	1812	20	9	-42	50.0	-155	38.0	105	8.9	2112.6	1140	25	9	-49	0.0	-145	0.0	90	.7
1401.4	2044	20	9	-42	56.0	-155	8.0	144	4.6	2123.0	145	26	9	-49	0.0	-144	44.0	192	9.2
1402.7	2100	20	9	-42	57.0	-155	7.0	104	8.9	2126.1	205	26	9	-49	3.0	-144	45.0	184	8.7
1595.2	1824	21	9	-43	43.0	-150	50.0	103	6.6	2160.2	600	26	9	-49	37.0	-144	49.0	198	7.4
1599.6	1904	21	9	-43	44.0	-150	44.0	103	8.8	2162.3	617	26	9	-49	39.0	-144	50.0	184	9.2
1625.6	2200	21	9	-43	50.0	-150	9.0	106	8.7	2238.5	1430	26	9	-50	55.0	-144	59.0	189	6.9
1651.1	55	22	9	-43	57.0	-149	35.0	109	5.8	2242.6	1505	26	9	-50	59.0	-145	0.0	170	.6
1654.1	126	22	9	-43	58.0	-149	31.0	107	9.7	2249.7	135	27	9	-51	6.0	-144	58.0	285	5.1
1664.6	231	22	9	-44	1.0	-149	17.0	115	7.5	2253.6	220	27	9	-51	5.0	-145	4.0	90	.4
1667.0	250	22	9	-44	2.0	-149	14.0	98	8.7	2254.2	340	27	9	-51	5.0	-145	3.0	180	.5
1674.3	340	22	9	-44	3.0	-149	4.0	90	8.6	2257.2	936	27	9	-51	8.0	-145	3.0	173	6.5
1675.0	345	22	9	-44	3.0	-149	3.0	108	9.5	2262.3	1022	27	9	-51	13.0	-145	2.0	177	8.3
1782.8	1500	22	9	-44	37.0	-146	40.0	115	5.8	2314.4	1637	27	9	-52	5.0	-144	57.0	173	7.1
1785.1	1524	22	9	-44	38.0	-146	37.0	109	9.0	2319.4	1719	27	9	-52	10.0	-144	56.0	180	8.5
1788.2	1544	22	9	-44	39.0	-146	33.0	103	11.5	2320.4	1726	27	9	-52	11.0	-144	56.0	168	6.3
1814.4	1800	22	9	-44	45.0	-145	57.0	102	7.7	2323.5	1755	27	9	-52	14.0	-144	55.0	180	8.6
1837.7	2100	22	9	-44	50.0	-145	25.0	118	2.1	2353.5	2122	27	9	-52	44.0	-144	55.0	195	2.5
1844.1	0	23	9	-44	53.0	-145	17.0	120	1.7	2362.8	100	28	9	-52	53.0	-144	59.0	241	2.0
1858.0	800	23	9	-45	0.0	-145	0.0	106	2.0	2364.8	200	28	9	-52	54.0	-145	2.0	207	.6
1865.4	1140	23	9	-45	2.0	-144	50.0	161	.2	2371.6	1310	28	9	-53	0.0	-145	7.0	180	7.9
1867.5	2116	23	9	-45	4.0	-144	49.0	185	8.0	2373.6	1325	28	9	-53	2.0	-145	7.0	172	9.7
1883.6	2315	23	9	-45	20.0	-144	51.0	187	6.5	2433.1	1933	28	9	-54	1.0	-144	53.0	174	7.5
1889.6	10	24	9	-45	26.0	-144	52.0	183	8.6	2439.2	2021	28	9	-54	7.0	-144	52.0	172	9.7
1935.7	530	24	9	-46	12.0	-144	56.0	180	7.9	2484.6	100	29	9	-54	52.0	-144	41.0	180	9.0
1937.7	545	24	9	-46	14.0	-144	56.0	184	8.2	2487.6	120	29	9	-54	55.0	-144	41.0	173	10.2
1948.7	705	24	9	-46	25.0	-144	57.0	184	12.0	2509.8	330	29	9	-55	17.0	-144	36.0	90	1.7
1978.8	935	24	9	-46	55.0	-145	0.0	180	5.9	2510.4	350	29	9	-55	17.0	-144	35.0	157	.6
1979.8	945	24	9	-46	56.0	-145	0.0	146	4.8	2514.7	1032	29	9	-55	21.0	-144	32.0	180	6.0
1981.0	1000	24	9	-46	57.0	-144	59.0	199	1.6	2520.7	1132	29	9	-55	27.0	-144	32.0	180	8.8
1985.2	1235	24	9	-47	1.0	-145	1.0	180	1.7	2573.7	1730	29	9	-56	20.0	-144	32.0	180	6.3
1988.2	1415	24	9	-47	4.0	-145	1.0	70	.5	2578.7	1817	29	9	-56	25.0	-144	32.0	90	1.7
1994.0	20	25	9	-47	2.0	-144	53.0	180	9.0	2580.9	1934	29	9	-56	25.0	-144	28.0	0	4.7

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2584.9	2025	29	9	-56	21.0	-144	28.0	121	•7	2871.9	1553	3	10	-59	50.0	-144	48.0	252	•8
2586.9	2253	29	9	-56	22.0	-144	25.0	347	2.5	2875.0	194.1	3	10	-59	51.0	-144	54.0	45	2.0
2594.1	140	30	9	-56	15.0	-144	28.0	144	1.1	2876.4	202.1	3	10	-59	50.0	-144	52.0	270	•2
2601.5	755	30	9	-56	21.0	-144	20.0	215	8.3	2877.5	235.1	3	10	-59	50.0	-144	54.0	180	8.0
2606.4	830	30	9	-56	25.0	-144	25.0	200	7.9	2879.5	10	4	10	-59	52.0	-144	54.0	180	9.0
2659.6	1512	30	9	-57	15.0	-144	58.0	190	6.5	2888.5	110	4	10	-60	1.0	-144	54.0	180	5.9
2662.6	1540	30	9	-57	18.0	-144	59.0	258	•5	2889.5	120	4	10	-60	2.0	-144	54.0	90	0.0
2667.6	3	1	10	-57	19.0	-145	8.0	152	8.0	2889.5	135	4	10	-60	2.0	-144	54.0	182	6.9
2669.8	20	1	10	-57	21.0	-145	6.0	174	7.5	2907.5	410	4	10	-60	20.0	-144	55.0	90	0.0
2674.9	100	1	10	-57	26.0	-145	5.0	180	6.0	2907.5	730	4	10	-60	20.0	-144	55.0	0	1.3
2680.9	200	1	10	-57	32.0	-145	5.0	178	8.6	2909.5	900	4	10	-60	18.0	-144	55.0	90	0.0
2706.9	500	1	10	-57	58.0	-145	3.0	180	4.8	2909.5	1000	4	10	-60	18.0	-144	55.0	0	3.0
2708.9	525	1	10	-58	0.0	-145	3.0	208	•2	2921.5	1400	4	10	-60	6.0	-144	55.0	90	7.4
2710.0	1025	1	10	-58	1.0	-145	4.0	131	2.9	2926.4	1440	4	10	-60	6.0	-144	45.0	90	8.5
2717.7	1300	1	10	-58	6.0	-144	53.0	295	1.2	2931.4	1515	4	10	-60	6.0	-144	35.0	0	12.0
2720.0	1450	1	10	-58	5.0	-144	57.0	322	4.9	2932.4	1520	4	10	-60	5.0	-144	35.0	346	4.1
2722.6	1521	1	10	-58	3.0	-145	0.0	139	1.1	2934.5	1550	4	10	-60	3.0	-144	36.0	355	9.4
2726.6	1855	1	10	-58	6.0	-144	55.0	170	5.2	2945.5	1700	4	10	-59	52.0	-144	38.0	333	8.7
2729.6	1930	1	10	-58	9.0	-144	54.0	182	9.0	2960.1	1840	4	10	-59	39.0	-144	51.0	324	7.8
2777.7	50	2	10	-58	57.0	-144	57.0	190	7.9	2968.7	1946	4	10	-59	32.0	-145	1.0	90	8.6
2780.7	113	2	10	-59	0.0	-144	58.0	226	1.7	2969.7	1953	4	10	-59	32.0	-144	59.0	135	6.5
2785.0	340	2	10	-59	3.0	-145	4.0	270	1.5	2971.2	2006	4	10	-59	33.0	-144	57.0	107	9.4
2786.0	420	2	10	-59	3.0	-145	6.0	153	•5	2981.2	2110	4	10	-59	36.0	-144	38.0	90	4.3
2787.2	613	2	10	-59	4.0	-145	5.0	242	3.0	2982.3	2124	4	10	-59	36.0	-144	36.0	112	8.4
2793.6	820	2	10	-59	7.0	-145	16.0	194	•4	2995.8	2300	4	10	-59	41.0	-144	11.0	127	9.8
2795.6	1300	2	10	-59	9.0	-145	17.0	0	1.4	3037.7	315	5	10	-60	6.0	-143	4.0	98	13.3
2797.6	1423	2	10	-59	7.0	-145	17.0	104	•5	3058.9	450	5	10	-60	9.0	-142	22.0	109	6.2
2801.8	2200	2	10	-59	8.0	-145	9.0	180	4.0	3062.0	520	5	10	-60	10.0	-142	16.0	270	1.3
2803.8	2230	2	10	-59	10.0	-145	9.0	177	8.0	3072.5	1320	5	10	-60	10.0	-142	37.0	90	7.4
2847.9	400	3	10	-59	54.0	-145	5.0	173	6.9	3075.0	1340	5	10	-60	10.0	-142	32.0	90	9.2
2851.9	435	3	10	-59	58.0	-145	4.0	90	3.2	3209.3	415	6	10	-60	9.0	-138	2.0	90	7.4
2854.9	530	3	10	-59	58.0	-144	58.0	45	•8	3209.8	419	6	10	-60	9.0	-138	1.0	117	8.3
2856.3	714	3	10	-59	57.0	-144	56.0	43	3.5	3212.0	435	6	10	-60	10.0	-137	57.0	121	10.7
2864.5	933	3	10	-59	51.0	-144	45.0	0	•8	3221.8	530	6	10	-60	15.0	-137	40.0	63	4.7
2868.5	1430	3	10	-59	47.0	-144	45.0	207	2.4	3224.1	558	6	10	-60	14.0	-137	36.0	0	3.9

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3226.1	628	6	10	-60	12.0	-137	36.0	143	1.7	3751.8	2220	10	10	-60	17.0	-121	55.0	112	6.4
3228.6	753	6	10	-60	14.0	-137	33.0	166	1.0	3754.4	2245	10	10	-60	18.0	-121	50.0	113	11.3
3230.6	955	6	10	-60	16.0	-137	32.0	206	1.8	3770.0	7	11	10	-60	24.0	-121	21.0	124	8.9
3235.1	1220	6	10	-60	20.0	-137	36.0	243	2.6	3771.8	19	11	10	-60	25.0	-121	18.0	114	11.5
3237.3	1310	6	10	-60	21.0	-137	40.0	270	.5	3791.2	200	11	10	-60	33.0	-120	42.0	106	9.5
3243.2	35	7	10	-60	21.0	-137	52.0	90	5.9	3889.2	1219	11	10	-61	0.0	-117	29.0	90	4.2
3246.7	110	7	10	-60	21.0	-137	45.0	90	8.5	3892.1	1300	11	10	-61	0.0	-117	23.0	200	3.5
3274.4	425	7	10	-60	21.0	-136	49.0	90	6.5	3900.7	1525	11	10	-61	8.0	-117	29.0	156	1.2
3275.4	434	7	10	-60	21.0	-136	47.0	90	9.0	3913.8	150	12	10	-61	20.0	-117	18.0	0	3.9
3376.3	1540	7	10	-60	21.0	-133	23.0	72	8.6	3915.8	220	12	10	-61	18.0	-117	18.0	136	1.1
3395.6	1754	7	10	-60	15.0	-132	46.0	45	4.4	3917.2	330	12	10	-61	19.0	-117	16.0	113	4.4
3397.0	1813	7	10	-60	14.0	-132	44.0	90	2.4	3919.8	405	12	10	-61	20.0	-117	11.0	106	8.7
3398.5	1850	7	10	-60	14.0	-132	41.0	50	2.1	3982.3	1114	12	10	-61	37.0	-115	5.0	111	8.8
3417.3	330	8	10	-60	2.0	-132	12.0	79	8.5	4035.9	1716	12	10	-61	56.0	-113	19.0	90	5.2
3438.7	600	8	10	-59	58.0	-131	30.0	82	9.6	4037.3	1732	12	10	-61	56.0	-113	16.0	100	9.7
3453.8	734	8	10	-59	56.0	-131	0.0	94	9.9	4054.0	1915	12	10	-61	59.0	-112	41.0	90	5.6
3557.6	1802	8	10	-60	3.0	-127	33.0	90	2.9	4056.4	1940	12	10	-61	59.0	-112	36.0	167	1.6
3559.1	1832	8	10	-60	3.0	-127	30.0	77	1.4	4058.4	2056	12	10	-62	1.0	-112	35.0	165	.6
3563.7	2140	8	10	-60	2.0	-127	21.0	153	.5	4067.7	1225	13	10	-62	10.0	-112	30.0	51	7.1
3569.3	700	9	10	-60	7.0	-127	16.0	72	1.0	4072.5	1305	13	10	-62	7.0	-112	22.0	48	9.1
3572.4	1000	9	10	-60	6.0	-127	10.0	206	1.3	4077.0	1334	13	10	-62	4.0	-112	15.0	90	5.1
3573.5	1050	9	10	-60	7.0	-127	11.0	145	1.1	4077.9	1345	13	10	-62	4.0	-112	13.0	48	7.0
3582.1	1812	9	10	-60	14.0	-127	1.0	90	6.4	4082.4	1423	13	10	-62	1.0	-112	6.0	43	6.8
3584.6	1835	9	10	-60	14.0	-126	56.0	90	10.2	4083.7	1435	13	10	-62	0.0	-112	4.0	53	8.9
3594.0	1930	9	10	-60	14.0	-126	37.0	94	6.9	4162.8	2327	13	10	-61	12.0	-109	52.0	55	4.0
3608.0	2130	9	10	-60	15.0	-126	9.0	90	11.9	4164.5	2353	13	10	-61	11.0	-109	49.0	49	9.2
3637.7	0	10	10	-60	15.0	-125	9.0	90	10.2	4176.7	112	14	10	-61	3.0	-109	30.0	71	10.2
3647.2	55	10	10	-60	15.0	-124	50.0	82	9.6	4179.8	130	14	10	-61	2.0	-109	24.0	48	11.0
3681.8	430	10	10	-60	10.0	-123	41.0	90	9.0	4232.2	616	14	10	-60	27.0	-108	4.0	56	5.6
3714.2	805	10	10	-60	10.0	-122	36.0	117	6.6	4234.0	635	14	10	-60	26.0	-108	1.0	49	9.5
3716.4	825	10	10	-60	11.0	-122	32.0	337	2.6	4264.4	945	14	10	-60	6.0	-107	15.0	45	5.6
3724.0	1115	10	10	-60	4.0	-122	38.0	207	1.4	4265.8	1000	14	10	-60	5.0	-107	13.0	45	11.3
3725.1	1200	10	10	-60	5.0	-122	39.0	180	.3	4268.6	1015	14	10	-60	3.0	-107	9.0	56	8.3
3728.1	1946	10	10	-60	8.0	-122	39.0	112	8.0	4270.4	1028	14	10	-60	2.0	-107	6.0	50	10.1
3730.8	2006	10	10	-60	9.0	-122	34.0	112	9.3	4361.9	1930	14	10	-59	3.0	-104	48.0	226	1.2

ELF. 20 NAVIGATION CONT'D

4363.3	2038	14	10	-59	4.0	-104	50.0	262	.8	4921.9	913	21	10	-53	42.0	-102	50.0	50	5.0
4384.1	2125	15	10	-59	7.0	-105	30.0	90	12.3	4925.0	950	21	10	-53	40.0	-102	46.0	50	9.3
4399.5	2240	15	10	-59	7.0	-105	0.0	123	5.5	4931.2	1030	21	10	-53	36.0	-102	38.0	61	4.0
4401.3	2300	15	10	-59	8.0	-104	57.0	136	1.5	4933.2	1100	21	10	-53	35.0	-102	35.0	31	6.9
4413.9	720	16	10	-59	17.0	-104	40.0	349	9.6	4936.7	1130	21	10	-53	32.0	-102	32.0	244	3.0
4433.2	920	16	10	-58	58.0	-104	47.0	340	3.9	4941.3	1300	21	10	-53	34.0	-102	39.0	230	2.3
4455.6	1500	16	10	-58	37.0	-105	2.0	311	4.5	4942.9	1340	21	10	-53	35.0	-102	41.0	109	1.3
4478.5	2000	16	10	-58	22.0	-105	35.0	47	10.7	4946.0	1555	21	10	-53	36.0	-102	36.0	119	.8
4510.8	2300	16	10	-58	0.0	-104	50.0	65	.5	4950.1	2100	21	10	-53	38.0	-102	30.0	156	.7
4515.5	740	17	10	-57	58.0	-104	42.0	196	1.8	4954.4	237	22	10	-53	42.0	-102	27.0	50	12.1
4524.9	1245	17	10	-58	7.0	-104	47.0	19	9.5	4959.1	300	22	10	-53	39.0	-102	21.0	31	9.3
4578.8	1825	17	10	-57	16.0	-104	14.0	312	5.8	4961.4	315	22	10	-53	37.0	-102	19.0	41	8.7
4596.9	2130	17	10	-57	4.0	-104	39.0	29	.7	5068.1	1526	22	10	-52	17.0	-100	22.0	37	9.4
4598.1	2300	17	10	-57	3.0	-104	38.0	185	2.4	5073.1	1558	22	10	-52	13.0	-100	17.0	43	5.4
4604.1	130	18	10	-57	9.0	-104	39.0	133	.6	5075.8	1628	22	10	-52	11.0	-100	14.0	43	8.5
4613.0	1410	18	10	-57	15.0	-104	27.0	345	8.2	5078.5	1647	22	10	-52	9.0	-100	11.0	17	6.6
4617.1	1440	18	10	-57	11.0	-104	29.0	343	8.2	5080.6	1706	22	10	-52	7.0	-100	10.0	43	9.6
4674.7	2140	18	10	-56	16.0	-105	0.0	346	8.5	5086.1	1740	22	10	-52	3.0	-100	4.0	51	7.3
4686.0	2300	18	10	-56	5.0	-105	5.0	0	4.7	5087.6	1753	22	10	-52	2.0	-100	2.0	67	.9
4688.0	2325	18	10	-56	3.0	-105	5.0	118	1.7	5103.0	930	23	10	-51	56.0	-99	39.0	285	5.7
4694.3	300	19	10	-56	6.0	-104	55.0	77	1.5	5110.7	1050	23	10	-51	54.0	-99	51.0	285	8.6
4698.9	600	19	10	-56	5.0	-104	47.0	90	1.1	5204.6	2145	23	10	-51	29.0	-102	17.0	292	6.4
4716.8	2117	19	10	-56	5.0	-104	15.0	337	6.8	5210.0	2235	23	10	-51	27.0	-102	25.0	231	3.8
4721.1	2155	19	10	-56	1.0	-104	18.0	339	10.3	5211.6	2300	23	10	-51	28.0	-102	27.0	231	.9
4738.3	2334	19	10	-55	45.0	-104	29.0	337	9.4	5213.2	43	24	10	-51	29.0	-102	29.0	245	2.6
4782.7	415	20	10	-55	4.0	-104	59.0	330	6.9	5222.7	420	24	10	-51	33.0	-102	43.0	79	1.1
4786.1	445	20	10	-55	1.0	-105	2.0	330	2.7	5233.5	1346	24	10	-51	31.0	-102	26.0	270	.9
4789.6	600	20	10	-54	58.0	-105	5.0	251	.8	5234.7	1505	24	10	-51	31.0	-102	28.0	328	4.4
4792.6	945	20	10	-54	59.0	-105	10.0	270	.7	5235.9	1521	24	10	-51	30.0	-102	29.0	298	8.4
4794.9	1240	20	10	-54	59.0	-105	14.0	262	.8	5238.0	1536	24	10	-51	29.0	-102	32.0	295	8.0
4801.9	2026	20	10	-55	0.0	-105	26.0	41	7.1	5315.0	110	25	10	-50	56.0	-104	23.0	287	8.1
4804.5	2048	20	10	-54	58.0	-105	23.0	53	9.5	5336.1	345	25	10	-50	50.0	-104	55.0	270	7.5
4859.0	230	21	10	-54	25.0	-104	8.0	46	9.4	5338.0	400	25	10	-50	50.0	-104	58.0	180	0.0
4902.6	706	21	10	-53	55.0	-103	14.0	60	6.0	5339.0	2050	25	10	-50	51.0	-104	58.0	308	6.4
4904.6	726	21	10	-53	54.0	-103	11.0	46	9.6	5342.2	2120	25	10	-50	49.0	-105	2.0	297	5.8

ELT. 20 NAVIGATION CONT'D

5431.1	1225	26	10	-50	8.0	-107	6.0	300	4.0	6655.9	1306	2	11	-44	30.0	-110	19.0	90	10.7
5477.7	2355	26	10	-49	45.0	-108	9.0	308	1.6	6656.7	1310	2	11	-44	30.0	-110	18.0	90	1.5
5479.4	56	27	10	-49	44.0	-108	11.0	302	4.8	6657.4	1338	2	11	-44	30.0	-110	17.0	92	9.2
5538.2	1304	27	10	-49	13.0	-109	28.0	304	7.5	6729.4	2123	2	11	-44	32.0	-108	36.0	90	7.1
5590.4	2000	27	10	-48	44.0	-110	34.0	304	7.5	6730.8	2135	2	11	-44	32.0	-108	34.0	90	10.3
5635.1	156	28	10	-48	19.0	-111	30.0	301	8.6	6743.0	2245	2	11	-44	32.0	-108	17.0	0	4.0
5713.6	1100	28	10	-47	39.0	-113	11.0	317	5.8	6744.0	2300	2	11	-44	31.0	-108	17.0	270	11.4
5714.3	1107	28	10	-47	38.5	-113	11.7	300	8.4	6746.8	2315	2	11	-44	31.0	-108	21.0	180	12.0
5791.9	2020	28	10	-47	0.0	-114	51.0	299	7.8	6747.8	2320	2	11	-44	32.0	-108	21.0	92	8.4
5828.7	100	29	10	-46	42.0	-115	38.0	299	3.9	6856.2	1212	3	11	-44	35.0	-105	49.0	94	6.1
5876.6	1310	29	10	-46	19.0	-116	39.0	296	8.6	6857.6	1226	3	11	-44	35.1	-105	47.0	94	9.7
5904.2	1622	29	10	-46	7.0	-117	15.0	270	4.6	6870.4	1345	3	11	-44	36.0	-105	29.0	90	0.0
5905.6	1640	29	10	-46	7.0	-117	17.0	299	10.7	6870.4	1350	3	11	-44	36.0	-105	29.0	93	9.0
6001.8	137	30	10	-45	21.0	-119	18.0	301	8.7	6933.1	2044	3	11	-44	39.0	-104	1.0	90	6.6
6096.2	1222	30	10	-44	32.0	-121	12.0	303	8.8	6936.7	2116	3	11	-44	39.0	-103	56.0	92	8.5
6116.6	1440	30	10	-44	21.0	-121	36.0	289	9.0	7072.6	1310	4	11	-44	44.0	-100	45.0	90	5.3
6134.8	1640	30	10	-44	15.0	-122	0.0	93	9.4	7074.0	1326	4	11	-44	44.0	-100	43.0	92	8.7
6228.7	237	31	10	-44	20.0	-119	49.0	122	5.6	7103.8	1651	4	11	-44	45.0	-100	1.0	93	6.7
6230.3	255	31	10	-44	20.9	-119	47.0	95	10.0	7106.0	1710	4	11	-44	45.1	-99	58.0	132	4
6244.0	416	31	10	-44	22.0	-119	28.0	90	7.1	7108.8	2300	4	11	-44	47.0	-99	55.0	90	8.7
6244.7	422	31	10	-44	22.0	-119	27.0	96	10.5	7119.5	13	5	11	-44	47.0	-99	40.0	90	5.9
6338.7	1318	31	10	-44	32.0	-117	16.0	87	9.1	7123.7	56	5	11	-44	47.0	-99	34.0	91	8.6
6443.8	50	1	11	-44	26.0	-114	49.0	90	7.4	7193.3	900	5	11	-44	48.0	-97	56.0	90	6.9
6448.8	130	1	11	-44	26.0	-114	42.0	92	9.4	7197.5	937	5	11	-44	48.0	-97	50.0	92	7.9
6587.3	1608	1	11	-44	30.0	-111	28.0	90	6.6	7203.2	1020	5	11	-44	48.2	-97	42.0	119	3.6
6590.9	1640	1	11	-44	30.0	-111	23.0	158	.8	7204.8	1047	5	11	-44	49.0	-97	40.0	91	8.5
6598.4	148	2	11	-44	37.0	-111	19.0	340	5.0	7318.3	0	6	11	-44	50.0	-95	0.0	90	6.3
6600.5	213	2	11	-44	35.0	-111	20.0	270	3.2	7321.2	27	6	11	-44	50.0	-94	56.0	137	.9
6601.3	226	2	11	-44	35.0	-111	21.0	325	5.4	7325.3	438	6	11	-44	53.0	-94	52.0	125	1.6
6603.7	253	2	11	-44	33.0	-111	23.0	270	2.8	7327.0	540	6	11	-44	54.0	-94	50.0	180	2.9
6604.4	308	2	11	-44	33.0	-111	24.0	313	4.1	7327.5	550	6	11	-44	54.5	-94	50.0	100	5.7
6607.4	350	2	11	-44	31.0	-111	27.0	90	9.5	7330.4	620	6	11	-44	55.0	-94	46.0	91	8.5
6647.3	800	2	11	-44	31.0	-110	31.0	79	1.2	7459.3	2128	6	11	-44	57.0	-91	44.0	94	5.1
6652.4	1212	2	11	-44	30.0	-110	24.0	90	5.5	7463.5	2218	6	11	-44	57.3	-91	38.0	91	8.5
6654.5	1235	2	11	-44	30.0	-110	21.0	90	2.7	7527.2	545	7	11	-44	58.0	-90	8.0	90	8.4

ELT. 20 NAVIGATION CONT'D

7531.5	615	7 11	-44	58.0	-90	2.0	90	1.1
7535.0	925	7 11	-44	58.0	-89	57.0	170	1.9
7539.1	1130	7 11	-45	2.0	-89	56.0	90	0.0
7539.1	1145	7 11	-45	2.0	-89	56.0	35	9.7
7541.5	1200	7 11	-45	0.0	-89	54.0	52	8.6
7645.0	0	8 11	-43	56.0	-88	0.0	51	9.9
7656.1	107	8 11	-43	49.0	-87	48.0	36	6.1
7657.4	119	8 11	-43	48.0	-87	47.0	45	10.4
7664.5	200	8 11	-43	43.0	-87	40.0	90	5.4
7665.2	208	8 11	-43	43.0	-87	39.0	47	9.4
7876.8	38	9 11	-41	18.0	-84	10.0	48	6.6
7879.8	105	9 11	-41	16.0	-84	7.0	47	9.5
7955.7	900	9 11	-40	24.0	-82	54.0	50	8.7
8036.1	1810	9 11	-39	32.0	-81	34.0	38	5.0
8037.3	1825	9 11	-39	31.0	-81	33.0	48	11.5
8050.8	1935	9 11	-39	22.0	-81	20.0	38	7.5
8052.1	1945	9 11	-39	21.0	-81	19.0	51	8.7
8180.1	1024	10 11	-38	0.0	-79	12.0	50	9.5
8231.0	1545	10 11	-37	27.0	-78	23.0	38	7.6
8232.3	1555	10 11	-37	26.0	-78	22.0	50	11.3
8238.5	1628	10 11	-37	22.0	-78	16.0	90	11.9
8239.3	1632	10 11	-37	22.0	-78	15.0	47	9.0
8248.0	1730	10 11	-37	16.0	-78	7.0	50	8.1
8251.1	1753	10 11	-37	14.0	-78	4.0	50	10.5
8260.5	1846	10 11	-37	8.0	-77	55.0	58	8.0
8262.4	1900	10 11	-37	7.0	-77	53.0	49	9.4
8355.1	450	11 11	-36	6.0	-76	26.0	49	10.1
8421.3	1122	11 11	-35	23.0	-75	24.0	52	9.9
8515.8	2050	11 11	-34	25.0	-73	53.0	53	10.2
8558.6	100	12 11	-33	59.0	-73	12.0	51	9.8
8633.4	835	12 11	-33	12.0	-72	2.0	59	14.0
8639.3	900	12 11	-33	9.0	-71	56.0	50	7.7
8647.0	1000	12 11	-33	4.0	-71	49.0	68	.6

FLTANIN 21 NAVIGATION

MILES	HOUR	DY	MO	LATITUDE	LONGITUDE	COUR	KTS	597.2	1142	27	11	-33	2.0	-82	2.0	248	.8
0.0	1130	23	11	-33	0.0	257	8.6	602.6	1820	27	11	-33	4.0	-82	8.0	270	4.1
4.3	1200	23	11	-33	1.0	239	7.8	606.8	1920	27	11	-33	4.0	-82	13.0	270	1.6
6.2	1215	23	11	-33	2.0	180	.2	607.6	1950	27	11	-33	4.0	-82	14.0	270	5.1
7.2	1646	23	11	-33	3.0	270	9.1	614.3	2108	27	11	-33	4.0	-82	22.0	90	0.0
13.9	1730	23	11	-33	3.0	270	4.1	614.3	2121	27	11	-33	4.0	-82	22.0	270	5.2
18.1	1830	23	11	-33	3.0	270	6.7	616.0	2140	27	11	-33	4.0	-82	24.0	275	7.8
19.8	1845	23	11	-33	3.0	270	5.7	690.9	715	28	11	-32	58.0	-83	53.0	270	2.2
29.8	2030	23	11	-33	3.0	266	9.0	692.6	800	28	11	-32	58.0	-83	55.0	257	2.1
148.3	934	24	11	-33	12.0	265	9.5	696.9	1000	28	11	-32	59.0	-84	0.0	245	4.6
185.2	1327	24	11	-33	15.0	270	.5	701.5	1100	28	11	-33	1.0	-84	5.0	239	2.1
189.4	2041	24	11	-33	15.0	140	4.1	703.5	1155	28	11	-33	2.0	-84	7.0	97	1.6
190.7	2100	24	11	-33	16.0	268	12.0	711.9	1700	28	11	-33	3.0	-83	57.0	59	.9
332.0	845	25	11	-33	21.0	259	11.0	715.8	2100	28	11	-33	1.0	-83	53.0	207	4.4
455.9	2000	25	11	-33	44.0	248	5.2	721.4	2215	28	11	-33	6.0	-83	56.0	270	3.3
458.5	2031	25	11	-33	45.0	186	1.7	722.2	2230	28	11	-33	6.0	-83	57.0	209	4.5
481.7	950	26	11	-34	8.0	270	1.7	729.1	0	29	11	-33	12.0	-84	1.0	220	2.0
482.5	1018	26	11	-34	8.0	220	5.3	730.4	39	29	11	-33	13.0	-84	2.0	90	1.3
485.1	1047	26	11	-34	10.0	140	.8	731.3	115	29	11	-33	13.0	-84	1.0	279	8.6
486.4	1220	26	11	-34	11.0	20	13.3	816.0	1100	29	11	-33	0.0	-85	41.0	270	8.8
508.7	1400	26	11	-33	50.0	314	9.8	827.8	1220	29	11	-33	0.0	-85	55.0	270	8.8
514.5	1435	26	11	-33	46.0	40	.2	830.3	1237	29	11	-33	0.0	-85	58.0	90	1.5
515.8	2100	26	11	-33	45.0	320	1.1	835.3	1555	29	11	-33	0.0	-85	52.0	180	2.8
518.4	2315	26	11	-33	43.0	0	2.9	837.3	1637	29	11	-33	2.0	-85	52.0	90	1.4
519.4	2335	26	11	-33	42.0	90	0.0	839.0	1745	29	11	-33	2.0	-85	50.0	180	2.0
519.4	2355	26	11	-33	42.0	297	9.8	840.0	1815	29	11	-33	3.0	-85	50.0	140	1.7
532.5	115	27	11	-33	36.0	320	5.2	841.3	1900	29	11	-33	4.0	-85	49.0	180	3.4
536.4	200	27	11	-33	33.0	270	1.1	852.3	2210	29	11	-33	15.0	-85	49.0	90	3.3
537.2	245	27	11	-33	33.0	301	4.2	853.1	2225	29	11	-33	15.0	-85	48.0	287	6.9
541.1	340	27	11	-33	31.0	270	2.5	856.6	2255	29	11	-33	14.0	-85	52.0	275	9.3
541.9	400	27	11	-33	31.0	307	10.0	946.5	830	30	11	-33	6.0	-87	39.0	290	9.5
550.3	450	27	11	-33	26.0	309	7.6	960.9	1000	30	11	-33	1.0	-87	55.0	320	6.5
553.5	515	27	11	-33	24.0	301	7.3	963.5	1024	30	11	-32	59.0	-87	57.0	270	1.1
594.4	1048	27	11	-33	3.0	301	4.8	965.1	1155	30	11	-32	59.0	-87	59.0	320	2.1
596.3	1112	27	11	-33	2.0	270	1.6	966.5	1232	30	11	-32	58.0	-88	0.0	59	2.2

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968.4	1325	30	11	-32	57.0	-87	58.0	220	1.5	1377.7	215	4	12	-36	39.0	-93	39.0	219	10.2
969.7	1416	30	11	-32	58.0	-87	59.0	107	.5	1380.3	230	4	12	-36	41.0	-93	41.0	105	.8
973.2	2035	30	11	-32	59.0	-87	55.0	220	1.7	1387.8	1100	4	12	-36	43.0	-93	32.0	238	2.2
974.5	2120	30	11	-33	0.0	-87	56.0	270	3.3	1389.7	1150	4	12	-36	44.0	-93	34.0	223	8.9
975.4	2135	30	11	-33	0.0	-87	57.0	270	8.0	1397.9	1245	4	12	-36	50.0	-93	41.0	219	5.1
1044.1	610	1	12	-33	0.0	-89	19.0	270	6.7	1399.1	1300	4	12	-36	51.0	-93	42.0	223	8.8
1045.8	625	1	12	-33	0.0	-89	21.0	270	3.7	1521.7	248	5	12	-38	21.0	-95	27.0	0	8.8
1050.8	745	1	12	-33	0.0	-89	27.0	270	3.3	1539.7	450	5	12	-38	3.0	-95	27.0	43	10.1
1051.7	800	1	12	-33	0.0	-89	28.0	270	4.5	1601.2	1055	5	12	-37	18.0	-94	34.0	35	5.8
1053.4	822	1	12	-33	0.0	-89	30.0	270	3.7	1603.8	1121	5	12	-37	16.0	-94	32.0	43	10.1
1055.0	849	1	12	-33	0.0	-89	32.0	270	2.7	1618.9	1250	5	12	-37	5.0	-94	19.0	39	5.1
1056.7	926	1	12	-33	0.0	-89	34.0	90	0.0	1620.2	1305	5	12	-37	4.0	-94	18.0	219	15.3
1056.7	930	1	12	-33	0.0	-89	34.0	180	.3	1622.7	1315	5	12	-37	6.0	-94	20.0	180	3.9
1057.7	1212	1	12	-33	1.0	-89	34.0	239	1.6	1623.7	1330	5	12	-37	7.0	-94	20.0	219	7.6
1059.7	1322	1	12	-33	2.0	-89	36.0	134	.7	1625.0	1340	5	12	-37	8.0	-94	21.0	219	2.5
1065.5	2100	1	12	-33	6.0	-89	31.0	140	.8	1627.6	1440	5	12	-37	10.0	-94	23.0	202	4.3
1066.8	2230	1	12	-33	7.0	-89	30.0	180	4.0	1629.7	1510	5	12	-37	12.0	-94	24.0	214	6.9
1067.8	2245	1	12	-33	8.0	-89	30.0	226	8.2	1644.1	1715	5	12	-37	24.0	-94	34.0	253	1.9
1146.0	815	2	12	-34	2.0	-90	38.0	239	4.6	1647.4	1900	5	12	-37	25.0	-94	38.0	238	1.1
1148.0	840	2	12	-34	3.0	-90	40.0	239	5.8	1649.3	2042	5	12	-37	26.0	-94	40.0	22	.7
1149.9	900	2	12	-34	4.0	-90	42.0	228	7.8	1651.5	2335	5	12	-37	24.0	-94	39.0	38	5.8
1200.3	1523	2	12	-34	38.0	-91	27.0	242	8.9	1652.8	2348	5	12	-37	23.0	-94	38.0	322	.9
1223.6	1800	2	12	-34	49.0	-91	52.0	224	9.9	1655.3	234	6	12	-37	21.0	-94	40.0	22	2.2
1231.9	1850	2	12	-34	55.0	-91	59.0	219	3.1	1659.6	430	6	12	-37	17.0	-94	38.0	321	.6
1233.2	1915	2	12	-34	56.0	-92	0.0	109	.9	1663.4	1026	6	12	-37	14.0	-94	41.0	219	5.4
1239.2	200	3	12	-34	58.0	-91	53.0	192	2.7	1664.7	1040	6	12	-37	15.0	-94	42.0	210	9.6
1243.3	330	3	12	-35	2.0	-91	54.0	158	.8	1736.6	1805	6	12	-38	17.0	-95	28.0	201	8.5
1245.5	610	3	12	-35	4.0	-91	53.0	263	3.8	1738.7	1820	6	12	-38	19.0	-95	29.0	123	1.1
1253.7	820	3	12	-35	5.0	-92	3.0	219	1.3	1740.6	2000	6	12	-38	20.0	-95	27.0	218	10.6
1255.0	918	3	12	-35	6.0	-92	4.0	90	.9	1749.5	2050	6	12	-38	27.0	-95	34.0	218	5.4
1255.8	1010	3	12	-35	6.0	-92	3.0	202	3.4	1755.9	2200	6	12	-38	32.0	-95	39.0	90	0.0
1258.0	1048	3	12	-35	8.0	-92	4.0	221	9.2	1755.9	2215	6	12	-38	32.0	-95	39.0	212	5.7
1304.7	1550	3	12	-35	43.0	-92	42.0	180	.9	1761.8	2317	6	12	-38	37.0	-95	43.0	218	2.1
1306.7	1753	3	12	-35	45.0	-92	42.0	231	5.1	1765.6	105	7	12	-38	40.0	-95	46.0	90	0.0
1309.9	1830	3	12	-35	47.0	-92	45.0	220	8.7	1765.6	110	7	12	-38	40.0	-95	46.0	201	6.4

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1767.7	130	7 12	-38	42.0	-95	47.0	220	6.7	2361.3	1651	10 12	-39	56.0	-107	23.0	270	.1
1825.4	1000	7 12	-39	26.0	-96	35.0	218	5.8	2362.8	140	11 12	-39	56.0	-107	25.0	303	2.1
1826.6	1013	7 12	-39	27.0	-96	36.0	213	10.1	2364.6	230	11 12	-39	55.0	-107	27.0	270	1.3
1833.8	1055	7 12	-39	33.0	-96	41.0	218	15.1	2366.9	415	11 12	-39	55.0	-107	30.0	0	1.3
1835.0	1100	7 12	-39	34.0	-96	42.0	218	9.4	2367.9	500	11 12	-39	54.0	-107	30.0	270	3.3
1838.8	1124	7 12	-39	37.0	-96	45.0	208	8.7	2372.5	623	11 12	-39	54.0	-107	36.0	90	0.0
1858.2	1337	7 12	-39	54.0	-96	57.0	207	8.7	2372.5	628	11 12	-39	54.0	-107	36.0	247	2.1
1861.5	1400	7 12	-39	57.0	-96	59.0	42	.6	2377.5	850	11 12	-39	56.0	-107	42.0	90	2.6
1869.6	323	8 12	-39	51.0	-96	52.0	90	3.2	2379.1	925	11 12	-39	56.0	-107	40.0	270	3.0
1870.3	337	8 12	-39	51.0	-96	51.0	270	2.7	2379.8	940	11 12	-39	56.0	-107	41.0	217	4.7
1874.2	500	8 12	-39	51.0	-96	56.0	270	3.3	2381.1	956	11 12	-39	57.0	-107	42.0	271	9.4
1877.3	555	8 12	-39	51.0	-97	0.0	38	.7	2469.3	1915	11 12	-39	55.0	-109	37.0	254	6.4
1878.5	740	8 12	-39	50.0	-96	59.0	282	6.2	2480.5	2058	11 12	-39	58.0	-109	51.0	270	5.4
1883.2	825	8 12	-39	49.0	-97	5.0	280	6.8	2482.0	2115	11 12	-39	58.0	-109	53.0	114	7.5
1900.4	1055	8 12	-39	46.0	-97	27.0	261	10.6	2484.5	2135	11 12	-39	59.0	-109	50.0	246	1.5
1912.9	1205	8 12	-39	48.0	-97	43.0	270	5.5	2487.0	2310	11 12	-40	0.0	-109	53.0	270	5.7
1915.2	1230	8 12	-39	48.0	-97	46.0	266	10.3	2488.5	2326	11 12	-40	0.0	-109	55.0	270	9.5
2001.4	2050	8 12	-39	54.0	-99	38.0	270	9.2	2526.1	322	12 12	-40	0.0	-110	44.0	270	6.1
2002.9	2100	8 12	-39	54.0	-99	40.0	265	10.0	2527.6	337	12 12	-40	0.0	-110	46.0	272	8.2
2062.9	300	9 12	-39	59.0	-100	58.0	271	8.8	2592.0	1125	12 12	-39	58.0	-112	10.0	270	4.5
2137.2	1125	9 12	-39	58.0	-102	35.0	270	5.2	2593.5	1145	12 12	-39	58.0	-112	12.0	90	10.2
2140.3	1200	9 12	-39	58.0	-102	39.0	267	11.2	2595.1	1154	12 12	-39	58.0	-112	10.0	90	.9
2158.7	1338	9 12	-39	59.0	-103	3.0	270	8.9	2596.6	1330	12 12	-39	58.0	-112	8.0	270	5.1
2164.1	1414	9 12	-39	59.0	-103	10.0	270	7.6	2598.1	1348	12 12	-39	58.0	-112	10.0	271	7.9
2165.6	1426	9 12	-39	59.0	-103	12.0	270	11.4	2687.8	105	13 12	-39	57.0	-114	7.0	270	3.6
2168.7	1442	9 12	-39	59.0	-103	16.0	270	5.1	2689.3	130	13 12	-39	57.0	-114	9.0	272	7.8
2169.5	1451	9 12	-39	59.0	-103	17.0	269	9.2	2760.0	1027	13 12	-39	54.0	-115	41.0	270	3.2
2248.4	2325	9 12	-40	0.0	-105	0.0	270	4.5	2761.5	1055	13 12	-39	54.0	-115	43.0	270	3.0
2249.9	2345	9 12	-40	0.0	-105	2.0	270	1.5	2763.0	1125	13 12	-39	54.0	-115	45.0	90	0.0
2253.0	140	10 12	-40	0.0	-105	6.0	270	7.6	2763.0	1130	13 12	-39	54.0	-115	45.0	270	6.9
2259.9	234	10 12	-40	0.0	-105	15.0	270	8.3	2767.6	1210	13 12	-39	54.0	-115	51.0	269	7.8
2313.5	900	10 12	-40	0.0	-106	25.0	267	11.7	2815.2	1813	13 12	-39	55.0	-116	53.0	270	4.3
2334.2	1046	10 12	-40	1.0	-106	52.0	273	9.2	2817.5	1845	13 12	-39	55.0	-116	56.0	270	4.6
2356.4	1310	10 12	-40	0.0	-107	21.0	270	2.5	2818.3	1855	13 12	-39	55.0	-116	57.0	273	9.5
2357.2	1328	10 12	-40	0.0	-107	22.0	349	1.2	2879.7	120	14 12	-39	52.0	-118	17.0	274	9.8

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2908.2	413	14	12	-39	50.0	-118	54.0	233	9.2	3268.1	1239	17	12	-44	47.0	-120	15.0	180	10.0
2924.6	600	14	12	-40	0.0	-119	11.0	270	7.7	3270.1	1251	17	12	-44	49.0	-120	15.0	175	9.2
2942.3	817	14	12	-40	0.0	-119	34.0	270	3.2	3347.4	2110	17	12	-46	6.0	-120	5.0	167	4.6
2943.8	845	14	12	-40	0.0	-119	36.0	270	3.2	3350.5	2150	17	12	-46	9.0	-120	4.0	180	11.9
2947.6	955	14	12	-40	0.0	-119	41.0	90	0.0	3352.5	2200	17	12	-46	11.0	-120	4.0	161	11.0
2947.6	1005	14	12	-40	0.0	-119	41.0	270	3.9	3356.7	2223	17	12	-46	15.0	-120	2.0	90	0.0
2953.0	1126	14	12	-40	0.0	-119	48.0	129	.9	3356.7	2227	17	12	-46	15.0	-120	2.0	171	8.0
2965.7	24	15	12	-40	8.0	-119	35.0	201	2.5	3369.8	5	18	12	-46	28.0	-119	59.0	180	9.4
2967.9	115	15	12	-40	10.0	-119	36.0	217	1.5	3384.8	140	18	12	-46	43.0	-119	59.0	180	9.5
2969.1	205	15	12	-40	11.0	-119	37.0	0	2.3	3411.8	430	18	12	-47	10.0	-119	59.0	180	5.4
2970.1	230	15	12	-40	10.0	-119	37.0	90	0.0	3413.8	452	18	12	-47	12.0	-119	59.0	180	7.4
2970.1	245	15	12	-40	10.0	-119	37.0	90	1.6	3414.8	500	18	12	-47	13.0	-119	59.0	180	6.0
2970.9	312	15	12	-40	10.0	-119	36.0	159	.8	3416.8	520	18	12	-47	15.0	-119	59.0	180	9.5
2973.1	538	15	12	-40	12.0	-119	35.0	180	1.5	3519.9	1610	18	12	-48	58.0	-120	0.0	180	4.0
2974.1	616	15	12	-40	13.0	-119	35.0	90	0.0	3520.9	1625	18	12	-48	59.0	-120	0.0	233	1.3
2974.1	620	15	12	-40	13.0	-119	35.0	180	10.6	3524.1	1854	18	12	-49	1.0	-120	4.0	233	.7
2982.1	705	15	12	-40	21.0	-119	35.0	143	.5	3525.8	2100	18	12	-49	2.0	-120	6.0	270	.3
2983.3	911	15	12	-40	22.0	-119	34.0	201	6.7	3526.5	2245	18	12	-49	2.0	-120	7.0	233	1.3
2985.4	930	15	12	-40	24.0	-119	35.0	186	9.6	3528.1	0	19	12	-49	3.0	-120	9.0	243	.7
3140.3	130	16	12	-42	58.0	-119	57.0	182	9.9	3530.3	246	19	12	-49	4.0	-120	12.0	198	.3
3200.4	732	16	12	-43	58.0	-120	0.0	180	8.0	3532.4	915	19	12	-49	6.0	-120	13.0	213	4.7
3202.4	747	16	12	-44	0.0	-120	0.0	90	2.3	3533.6	930	19	12	-49	7.0	-120	14.0	192	3.1
3203.1	805	16	12	-44	0.0	-119	59.0	292	.3	3536.7	1028	19	12	-49	10.0	-120	15.0	90	0.0
3208.5	2230	16	12	-43	58.0	-120	6.0	245	3.1	3536.7	1038	19	12	-49	10.0	-120	15.0	180	4.2
3210.9	2315	16	12	-43	59.0	-120	9.0	235	1.5	3537.7	1052	19	12	-49	11.0	-120	15.0	198	7.0
3212.6	25	17	12	-44	0.0	-120	11.0	324	.6	3539.8	1110	19	12	-49	13.0	-120	16.0	198	4.2
3215.1	417	17	12	-43	58.0	-120	13.0	206	6.4	3546.1	1240	19	12	-49	19.0	-120	19.0	180	2.1
3218.4	448	17	12	-44	1.0	-120	15.0	227	2.6	3547.1	1308	19	12	-49	20.0	-120	19.0	213	6.5
3221.4	555	17	12	-44	3.0	-120	18.0	90	2.5	3548.3	1319	19	12	-49	21.0	-120	20.0	198	4.6
3222.1	612	17	12	-44	3.0	-120	17.0	216	6.1	3550.4	1346	19	12	-49	23.0	-120	21.0	192	1.7
3227.0	700	17	12	-44	7.0	-120	21.0	216	2.1	3553.5	1530	19	12	-49	26.0	-120	22.0	147	1.3
3229.5	808	17	12	-44	9.0	-120	23.0	144	1.7	3554.7	1624	19	12	-49	27.0	-120	21.0	180	4.9
3230.7	850	17	12	-44	10.0	-120	22.0	180	2.5	3555.7	1636	19	12	-49	28.0	-120	21.0	180	6.6
3231.7	914	17	12	-44	11.0	-120	22.0	172	10.8	3556.7	1645	19	12	-49	29.0	-120	21.0	176	10.3
3267.1	1230	17	12	-44	46.0	-120	15.0	180	6.6	3574.7	1830	19	12	-49	47.0	-120	19.0	90	0.0

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3574.7	1835	19	12	-49	47.0	-120	19.0	175	10.2	3869.0	1750	21	12	-54	29.0	-119	44.0	164	2.9
3614.8	2230	19	12	-50	27.0	-120	14.0	168	6.1	3871.1	1833	21	12	-54	31.0	-119	43.0	90	1.2
3617.9	2300	19	12	-50	30.0	-120	13.0	180	10.9	3871.6	1900	21	12	-54	31.0	-119	42.0	90	0.0
3621.9	2322	19	12	-50	34.0	-120	13.0	176	9.6	3871.6	1930	21	12	-54	31.0	-119	42.0	180	4.6
3638.9	108	20	12	-50	51.0	-120	11.0	175	9.9	3872.6	1943	21	12	-54	32.0	-119	42.0	178	10.7
3686.1	552	20	12	-51	38.0	-120	5.0	176	9.3	3894.6	2146	21	12	-54	54.0	-119	41.0	180	9.9
3706.1	800	20	12	-51	58.0	-120	3.0	180	8.5	3898.6	2210	21	12	-54	58.0	-119	41.0	210	13.8
3708.1	814	20	12	-52	0.0	-120	3.0	163	1.4	3899.8	2215	21	12	-54	59.0	-119	42.0	183	15.0
3710.2	940	20	12	-52	2.0	-120	2.0	192	9.1	3911.8	2303	21	12	-55	11.0	-119	43.0	184	11.1
3713.3	1000	20	12	-52	5.0	-120	3.0	180	9.0	3919.8	2346	21	12	-55	19.0	-119	44.0	214	15.9
3722.3	1100	20	12	-52	14.0	-120	3.0	180	9.2	3927.0	13	22	12	-55	25.0	-119	51.0	246	8.7
3726.3	1126	20	12	-52	18.0	-120	3.0	180	8.9	3929.5	30	22	12	-55	26.0	-119	55.0	229	11.3
3743.3	1320	20	12	-52	35.0	-120	3.0	181	9.1	3931.0	38	22	12	-55	27.0	-119	57.0	164	1.4
3811.3	2046	20	12	-53	43.0	-120	4.0	180	8.2	3933.1	205	22	12	-55	29.0	-119	56.0	180	4.0
3815.3	2115	20	12	-53	47.0	-120	4.0	172	8.0	3934.1	220	22	12	-55	30.0	-119	56.0	180	5.9
3827.4	2245	20	12	-53	59.0	-120	1.0	180	4.0	3935.1	230	22	12	-55	31.0	-119	56.0	196	7.3
3828.4	2300	20	12	-54	0.0	-120	1.0	164	.9	3937.2	247	22	12	-55	33.0	-119	57.0	185	7.9
3830.5	118	21	12	-54	2.0	-120	0.0	113	2.5	3944.2	340	22	12	-55	40.0	-119	58.0	270	8.4
3833.1	217	21	12	-54	3.0	-119	56.0	196	1.0	3944.8	344	22	12	-55	40.0	-119	59.0	184	8.4
3835.1	420	21	12	-54	5.0	-119	57.0	90	0.0	3961.8	545	22	12	-55	57.0	-120	1.0	196	3.1
3835.1	450	21	12	-54	5.0	-119	57.0	90	0.0	3963.9	625	22	12	-55	59.0	-120	2.0	187	8.0
3835.1	500	21	12	-54	5.0	-119	57.0	109	1.6	3992.1	954	22	12	-56	27.0	-120	8.0	178	9.4
3838.2	650	21	12	-54	6.0	-119	52.0	90	1.0	4009.1	1142	22	12	-56	44.0	-120	7.0	177	8.4
3841.2	935	21	12	-54	6.0	-119	47.0	210	3.7	4020.1	1300	22	12	-56	55.0	-120	6.0	24	8.5
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3845.2	1100	21	12	-54	9.0	-119	51.0	180	1.9	4065.2	1820	22	12	-56	14.0	-119	32.0	195	10.6
3846.2	1130	21	12	-54	10.0	-119	51.0	90	1.9	4077.6	1930	22	12	-56	26.0	-119	38.0	200	6.3
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3860.4	1520	21	12	-54	21.0	-119	45.0	180	2.8	4091.5	28	23	12	-56	30.0	-119	36.0	220	.9
3865.4	1704	21	12	-54	26.0	-119	45.0	90	3.4	4096.7	541	23	12	-56	34.0	-119	42.0	48	6.0
3866.0	1714	21	12	-54	26.0	-119	44.0	180	5.0	4101.2	625	23	12	-56	31.0	-119	36.0	77	1.6

ELT. 21 NAVIGATION CONT'D

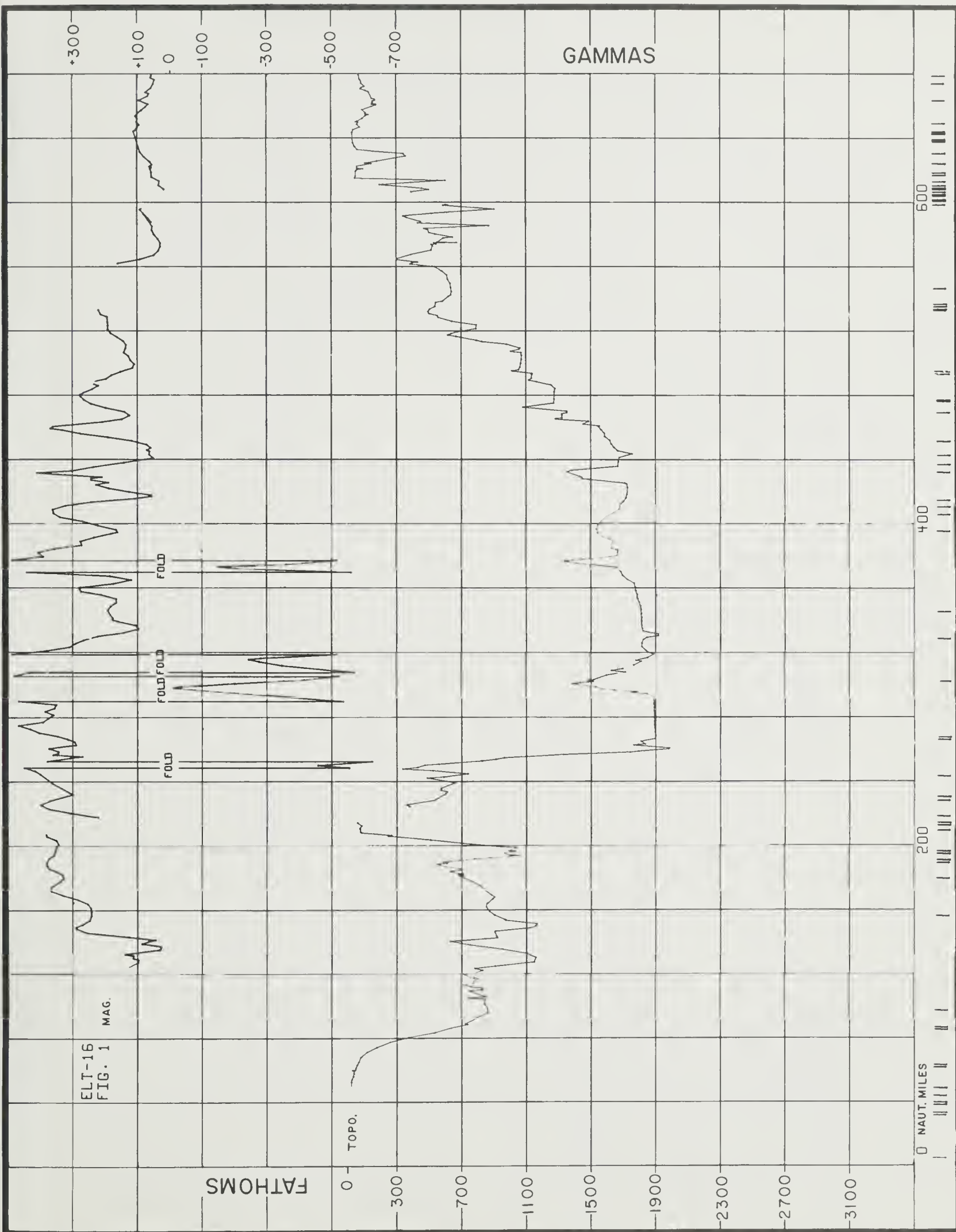
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4112.1	1320	23	12	-56	32.0	-119	20.0	312	3.5	4389.6	2128	25	12	-59	58.0	-120	5.0	180	10.0
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4114.7	1355	23	12	-56	31.0	-119	24.0	90	0.0	4402.6	2258	25	12	-60	11.0	-120	5.0	180	3.5
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4114.7	1406	23	12	-56	31.0	-119	24.0	90	0.0	4406.6	2353	25	12	-60	15.0	-120	5.0	154	2.3
4114.7	1409	23	12	-56	31.0	-119	24.0	270	8.2	4407.8	21	26	12	-60	16.0	-120	4.0	284	.3
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4119.0	1630	23	12	-56	30.0	-119	27.0	66	4.8	4414.3	1430	26	12	-60	15.0	-120	17.0	270	2.3
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4129.7	1920	23	12	-56	25.0	-119	16.0	294	3.6	4427.6	2110	26	12	-60	17.0	-120	0.0	90	1.7
4132.2	2000	23	12	-56	24.0	-119	20.0	294	2.9	4430.5	2250	26	12	-60	17.0	-119	54.0	243	2.5
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4350.6	1712	25	12	-59	19.0	-120	7.0	180	4.2	4537.8	815	28	12	-61	13.0	-120	9.0	107	3.6

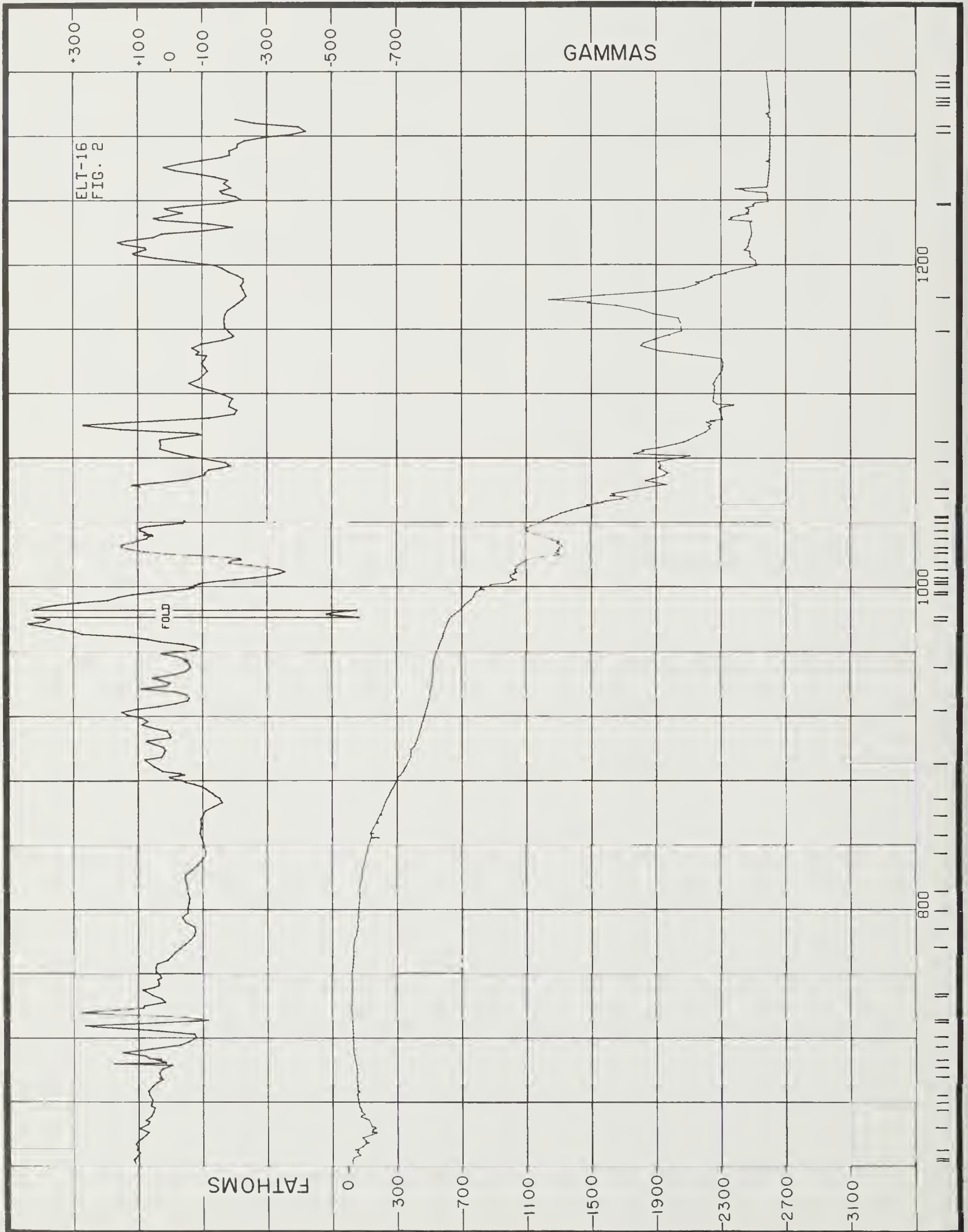
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4675.1	22	29	12	-61	32.0	-115	32.0	103	6.9	5304.4	335	1	1	-60	47.0	-94	52.0	44	5.5
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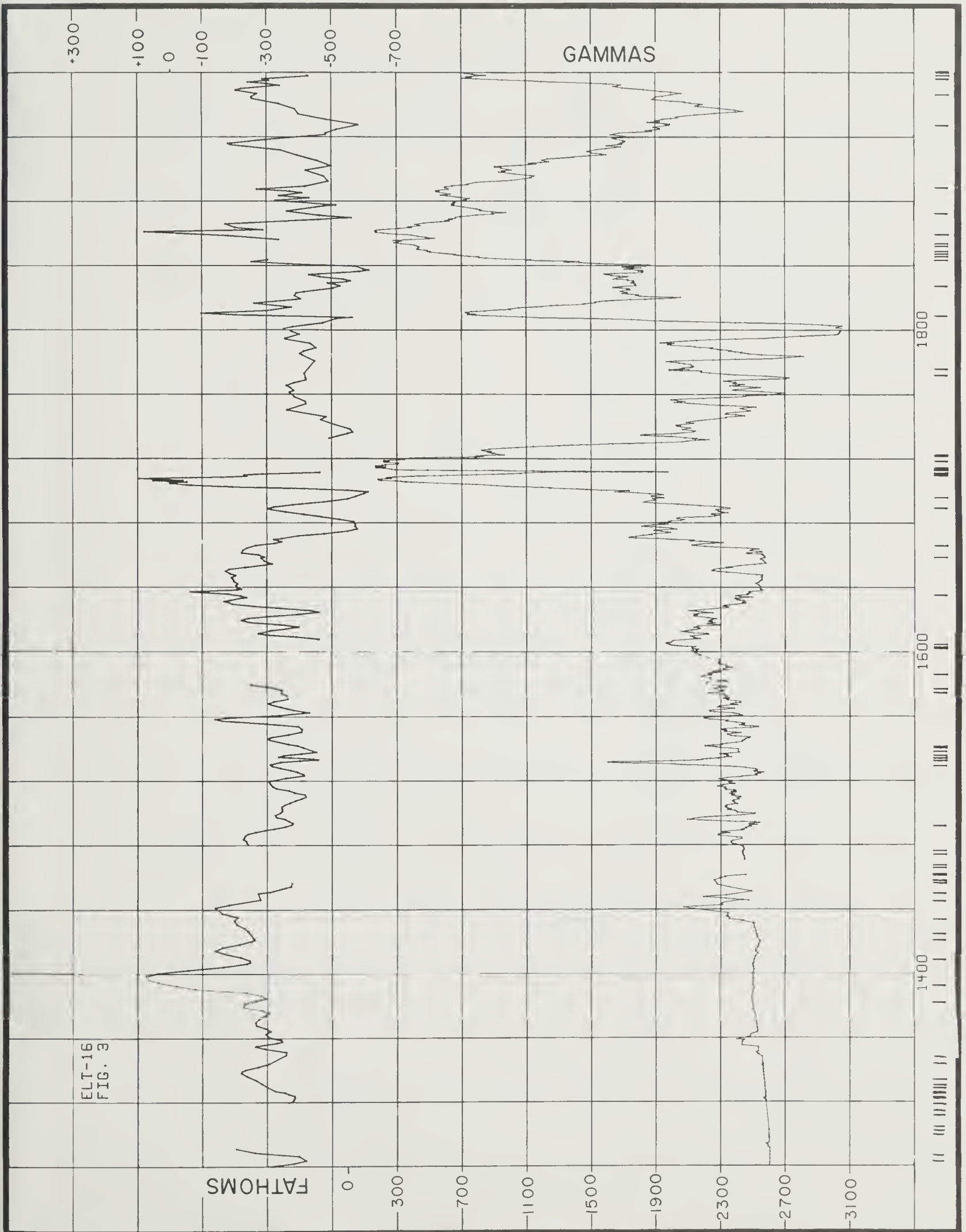
ELT. 21 NAVIGATION CONF'D

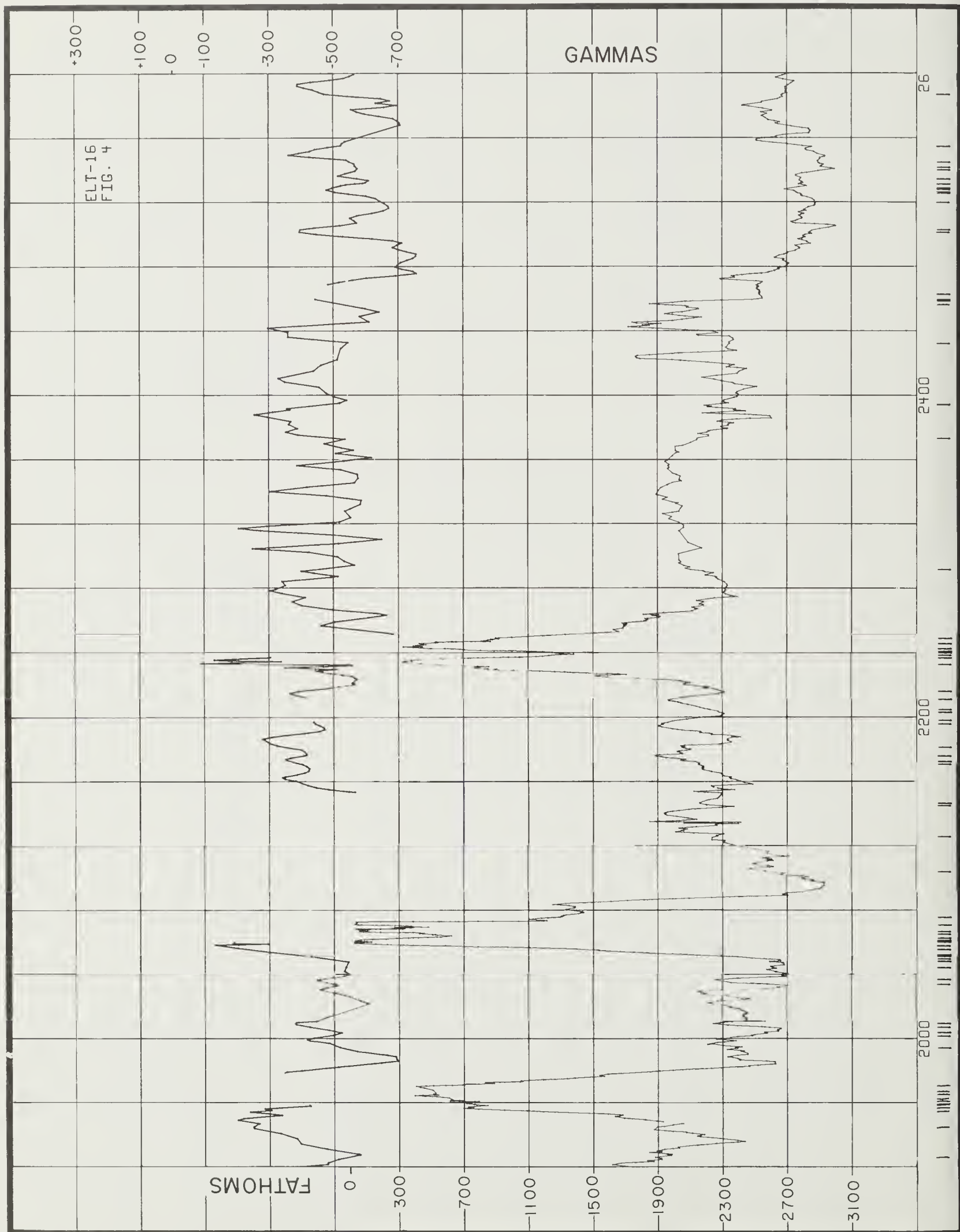
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5798.8	2013	3	1	-56	23.0	-83	23.0	60	9.9	6209.6	1030	6	1	-53	15.0	-75	19.0	42	12.9
5821.2	2227	3	1	-56	12.0	-82	48.0	59	5.4	6215.0	1055	6	1	-53	11.0	-75	13.0	12	10.6
5825.0	2310	3	1	-56	10.0	-82	42.0	66	9.7	6235.5	1250	6	1	-52	51.0	-75	6.0	270	3.2
5827.5	2325	3	1	-56	9.0	-82	38.0	48	8.9	6237.9	1335	6	1	-52	51.0	-75	10.0	108	4.0
5829.0	2335	3	1	-56	8.0	-82	36.0	58	10.1	6241.1	1422	6	1	-52	52.0	-75	5.0	270	4.0
5873.0	355	4	1	-55	45.0	-81	29.0	39	10.4	6247.7	1600	6	1	-52	52.0	-75	16.0	270	1.9
5916.9	808	4	1	-55	11.0	-80	40.0	40	11.2	6248.9	1637	6	1	-52	52.0	-75	18.0	270	7.2
5928.6	910	4	1	-55	2.0	-80	27.0	41	7.9	6249.5	1642	6	1	-52	52.0	-75	19.0	211	4.1
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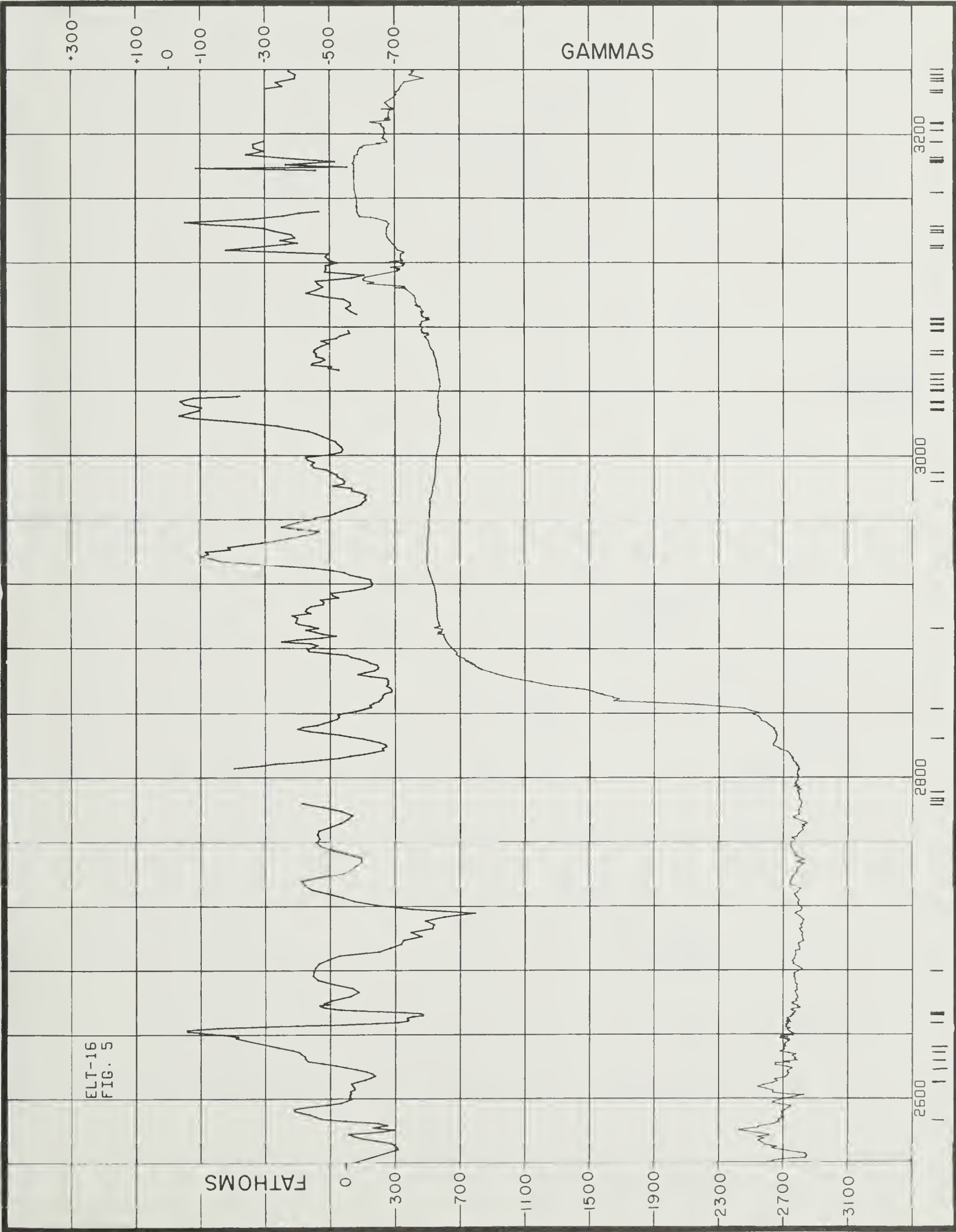
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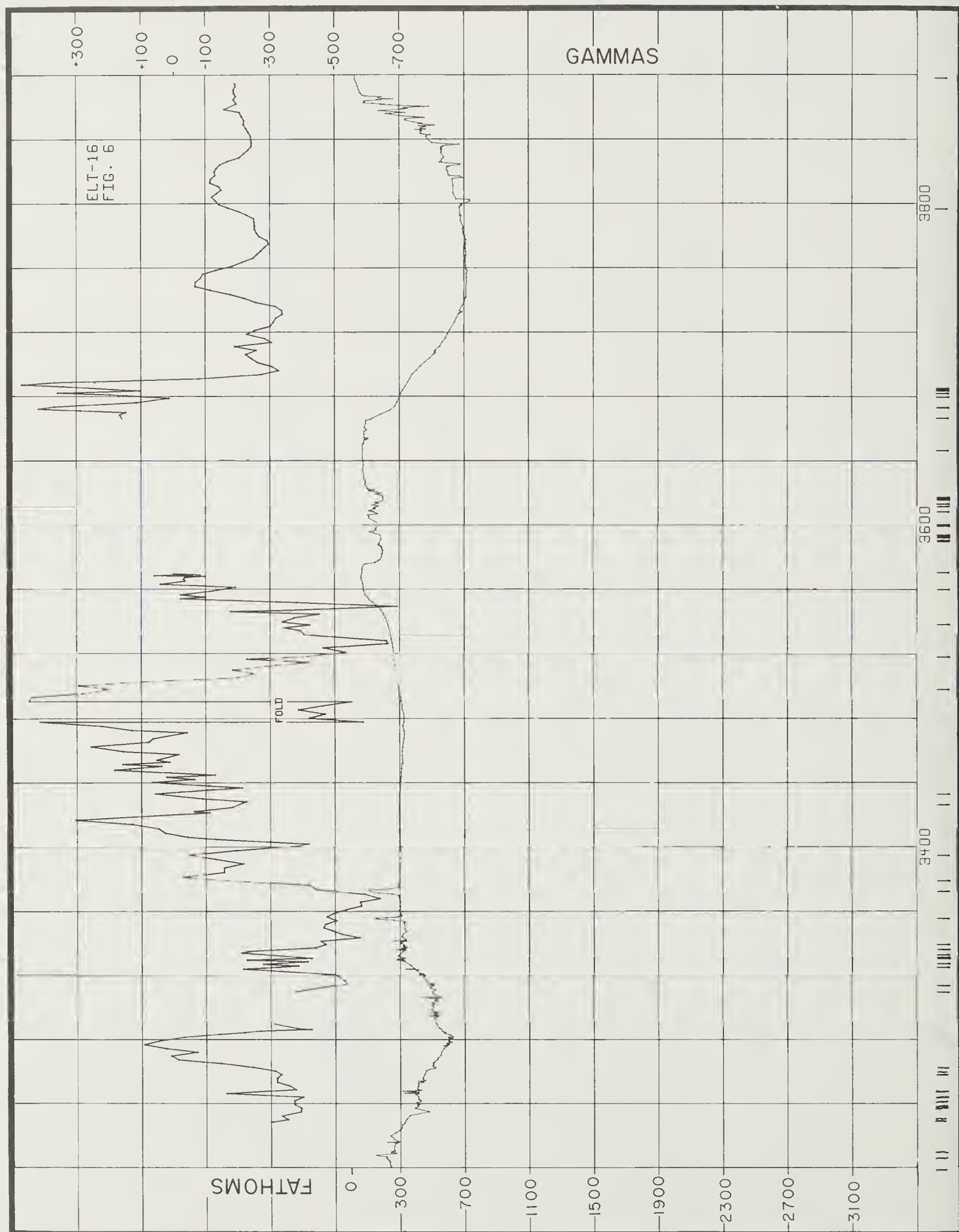


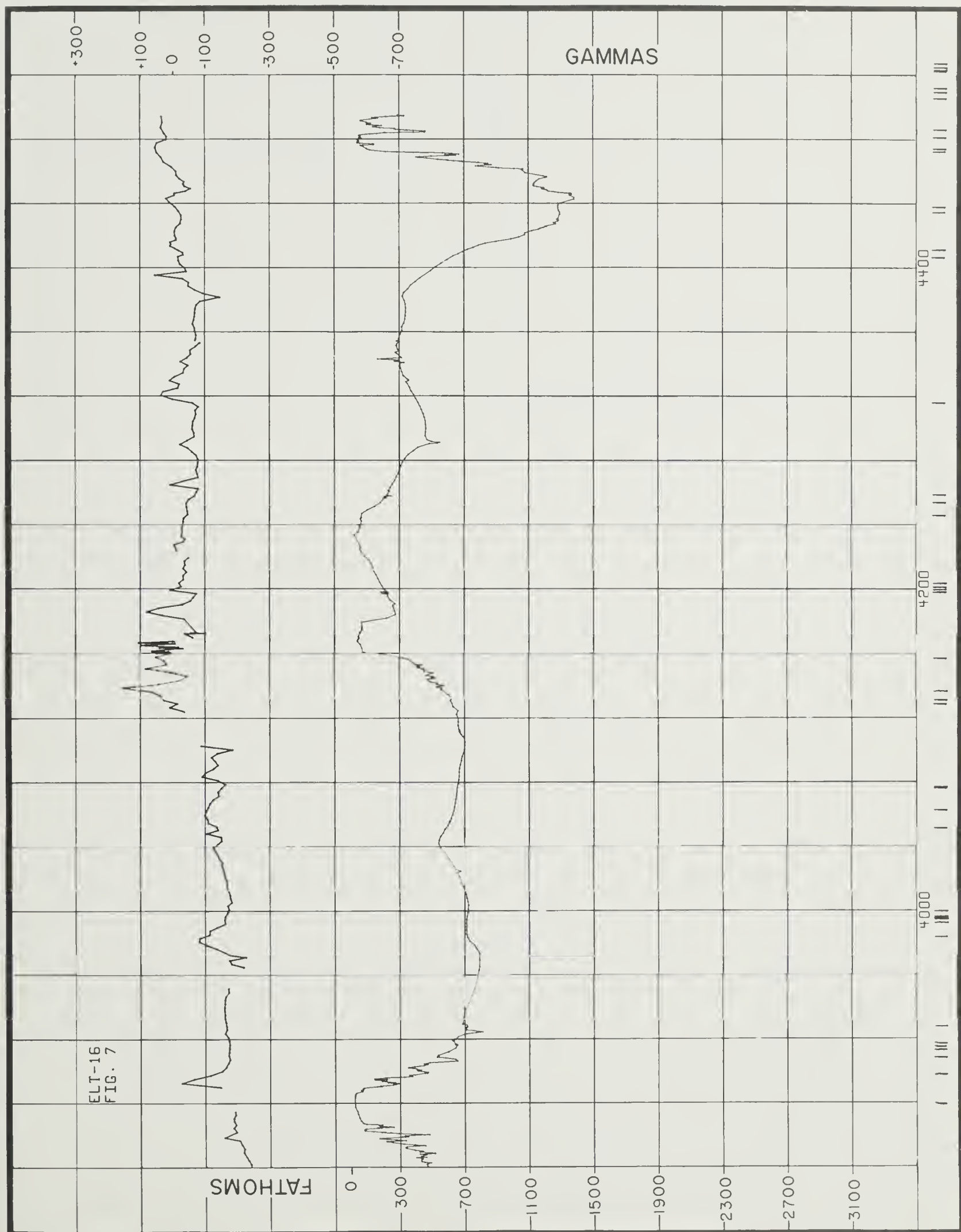




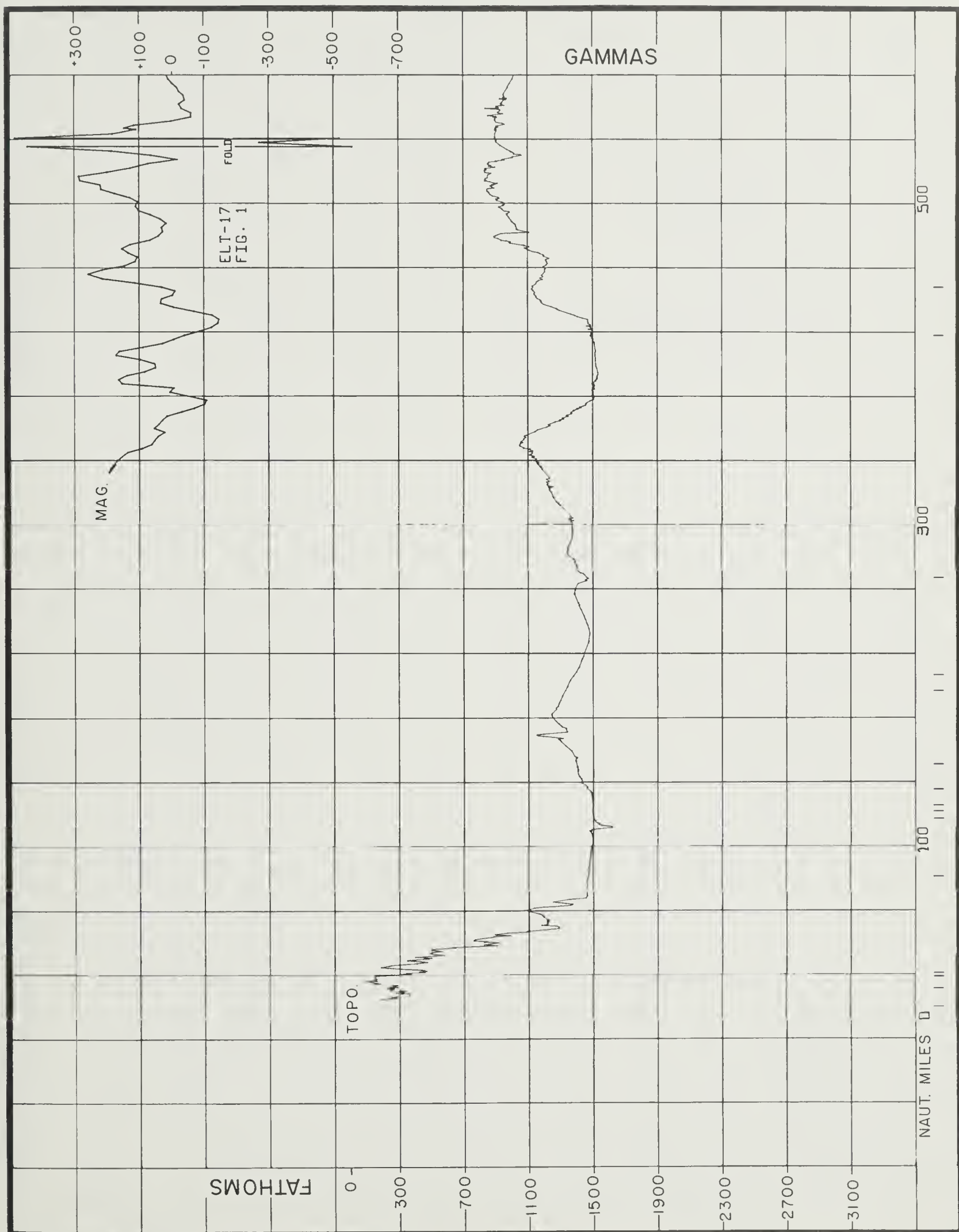


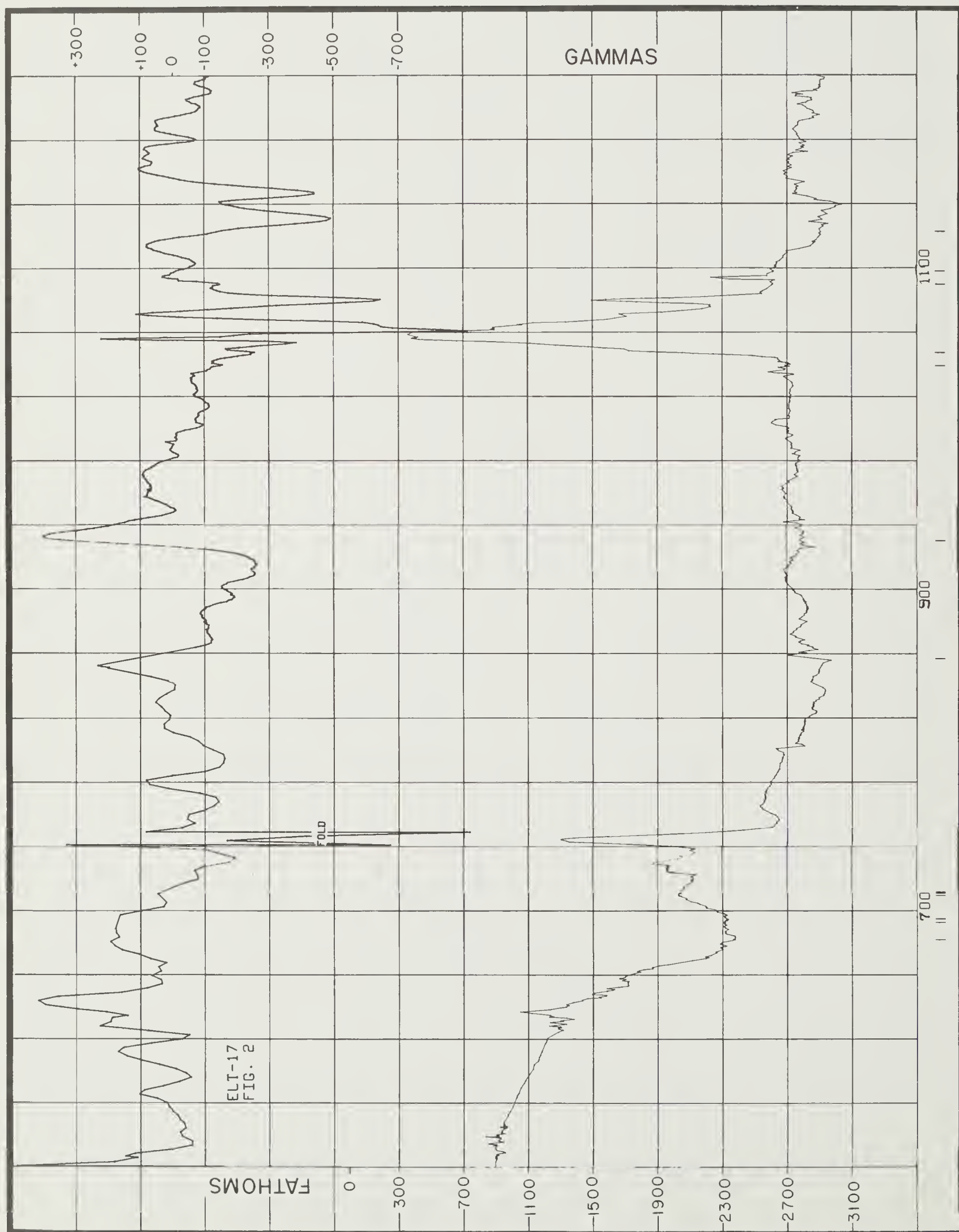


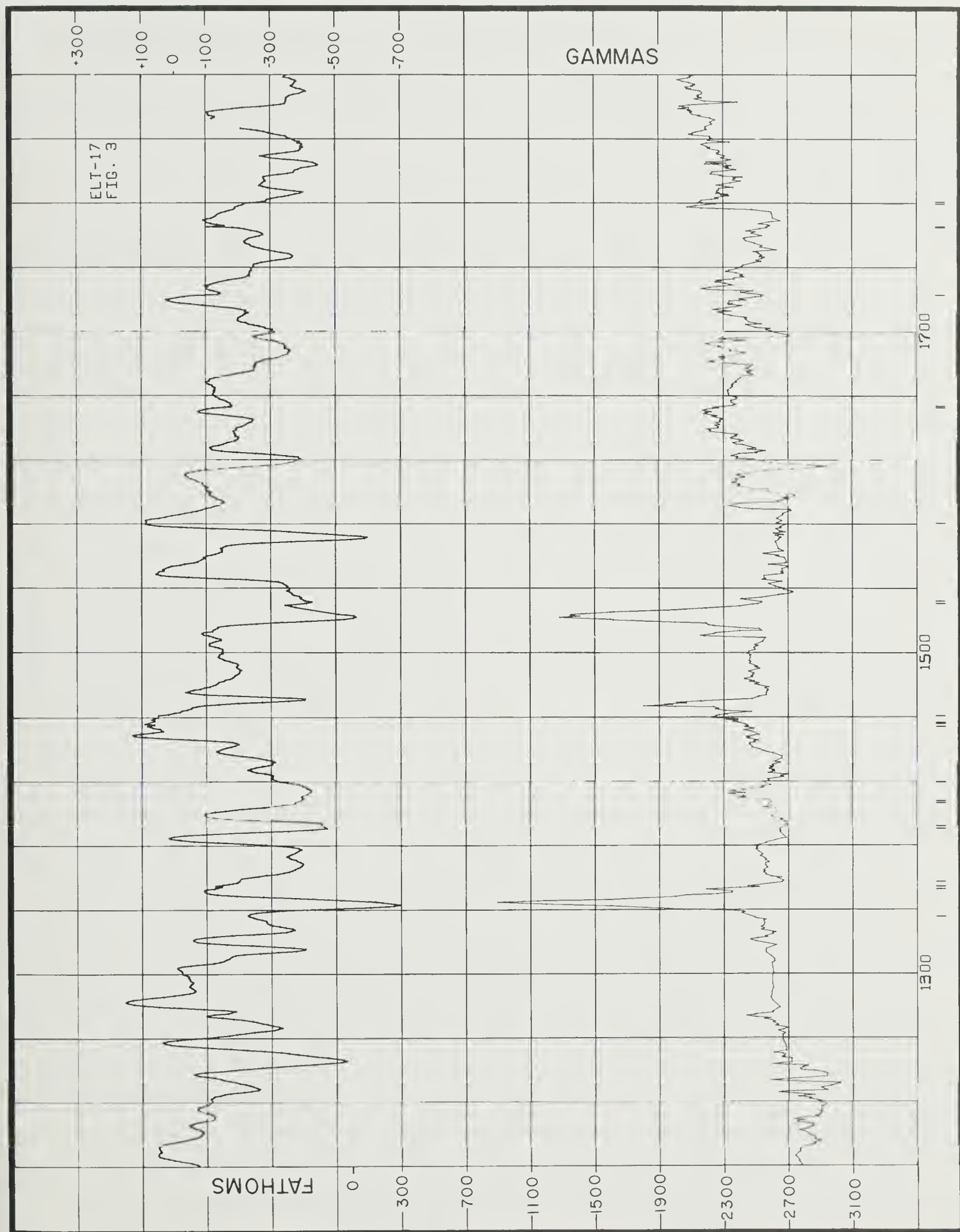


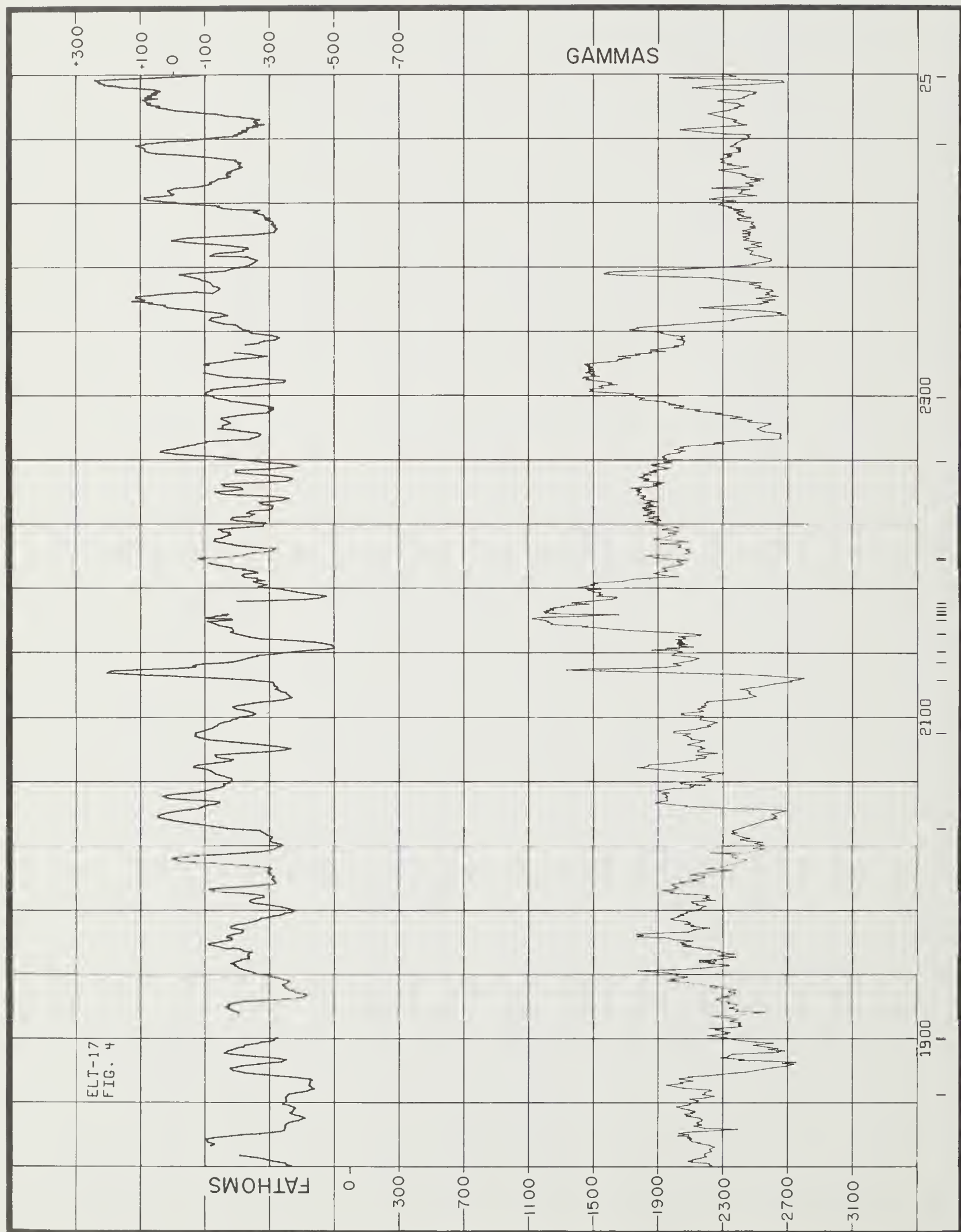


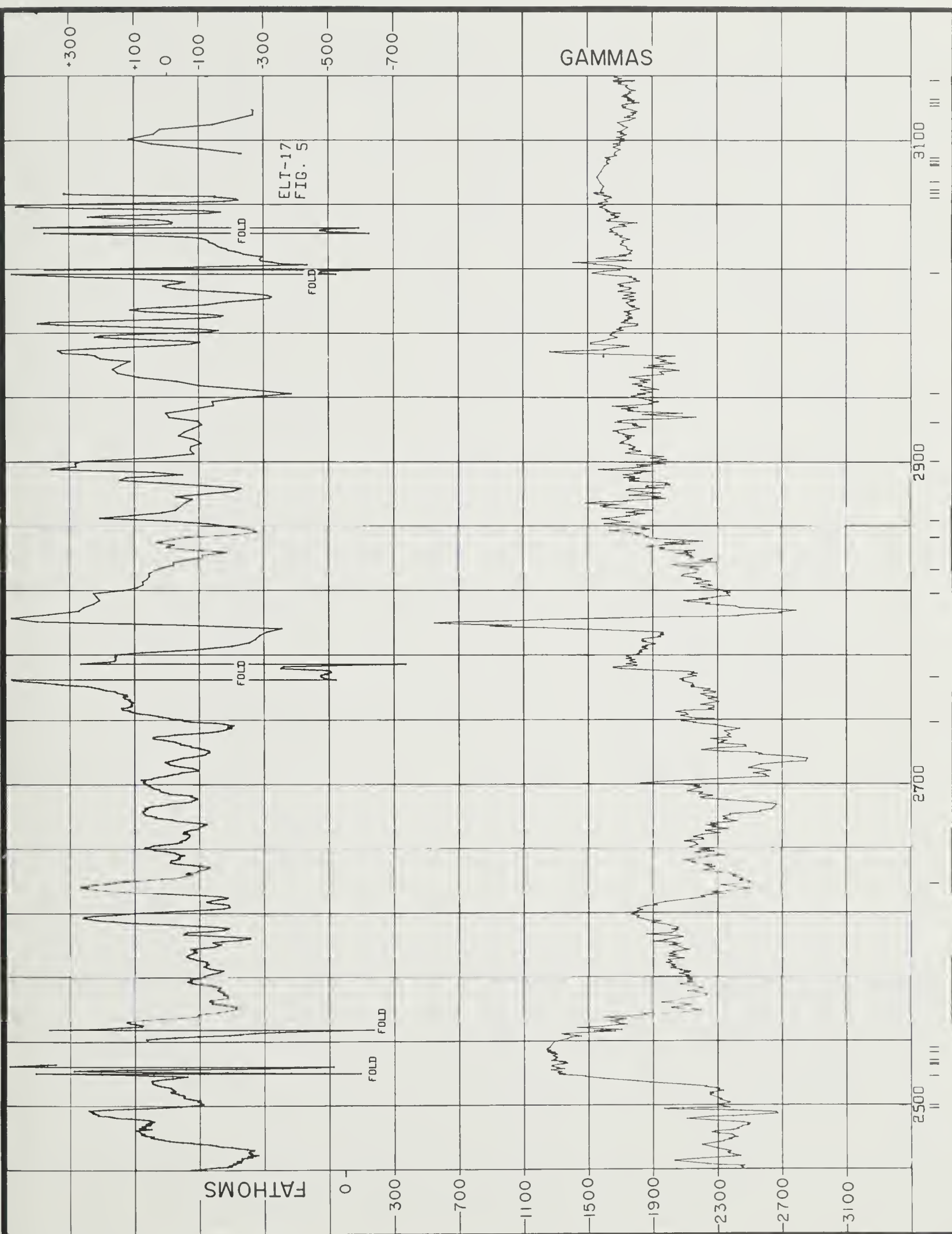


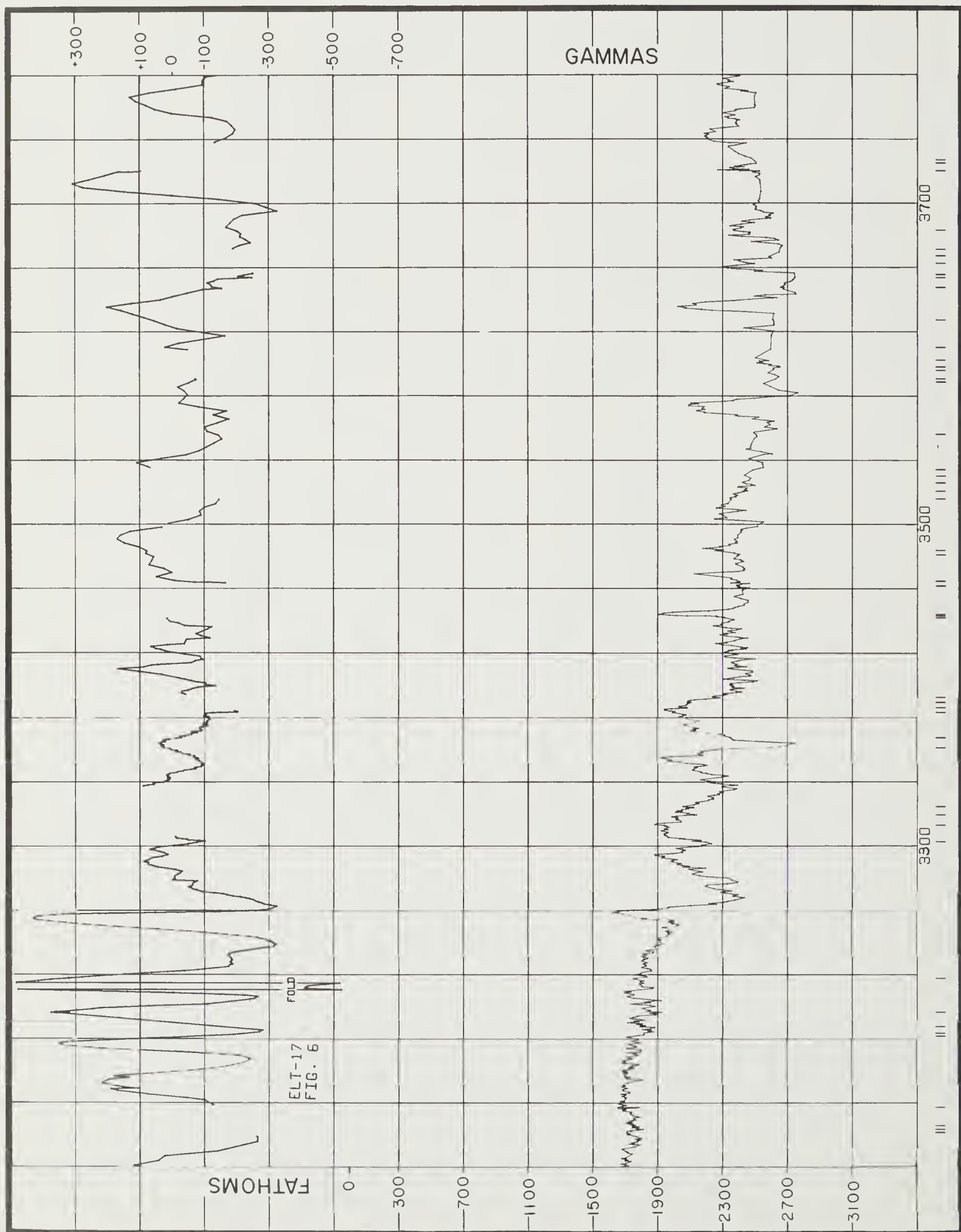


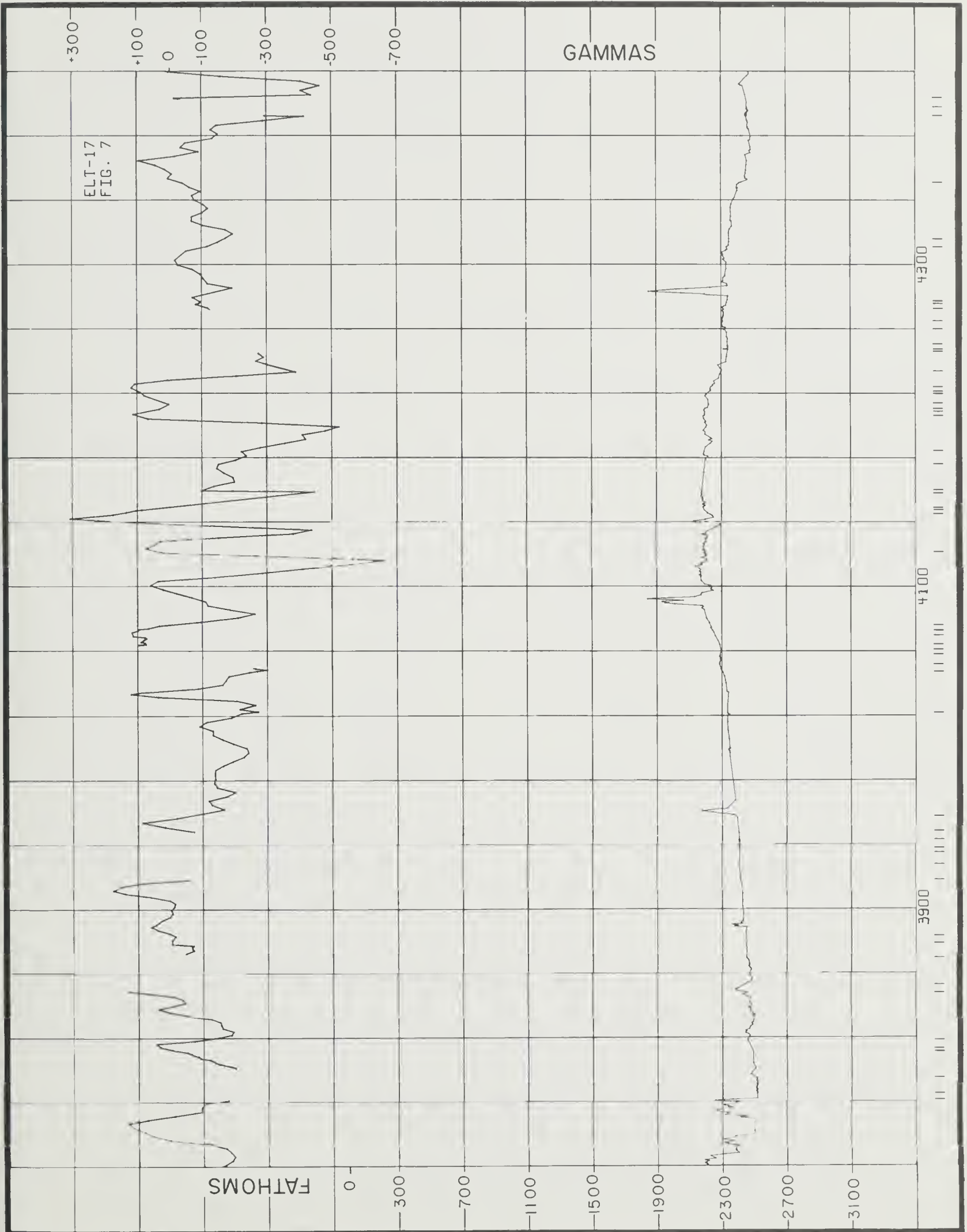


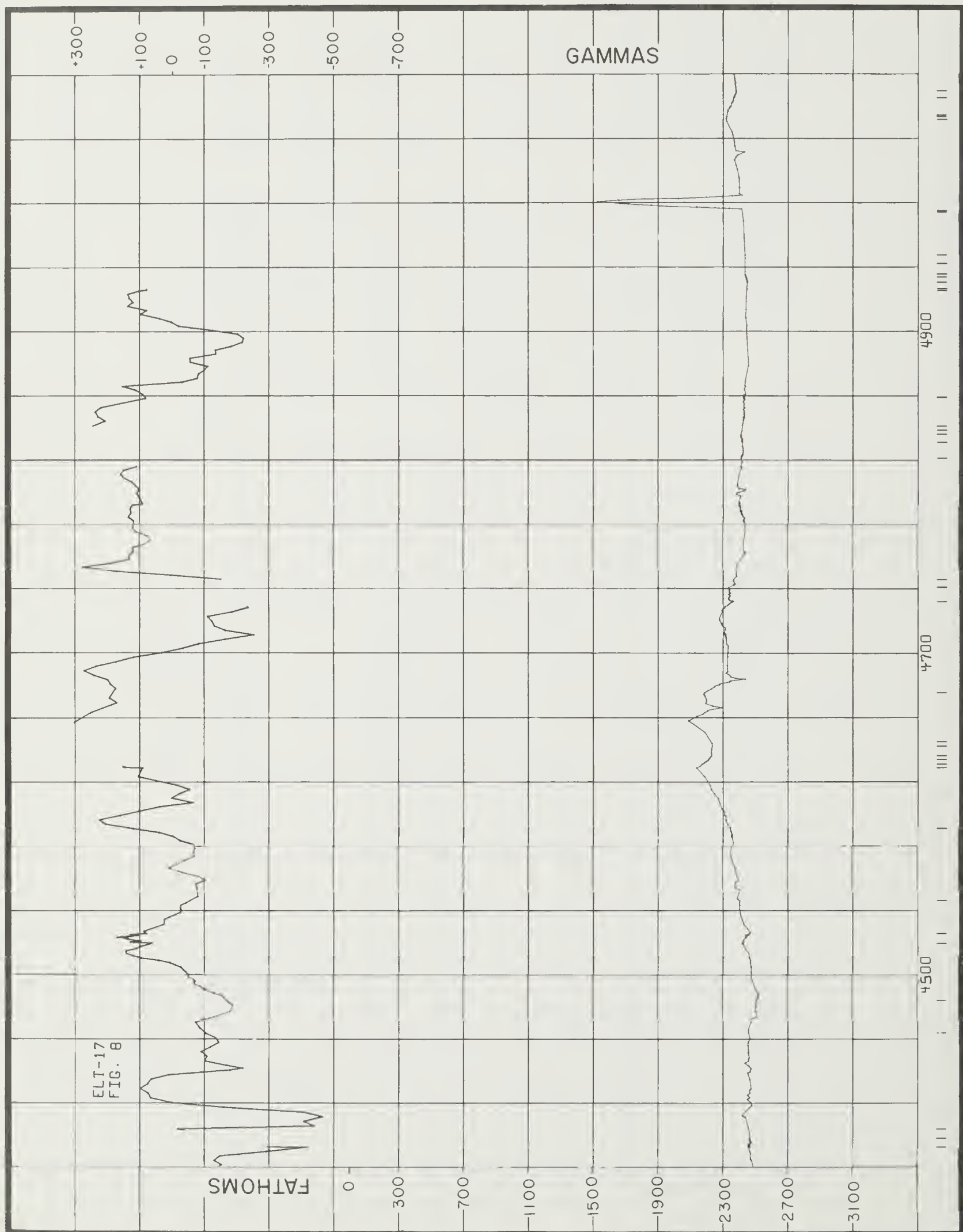


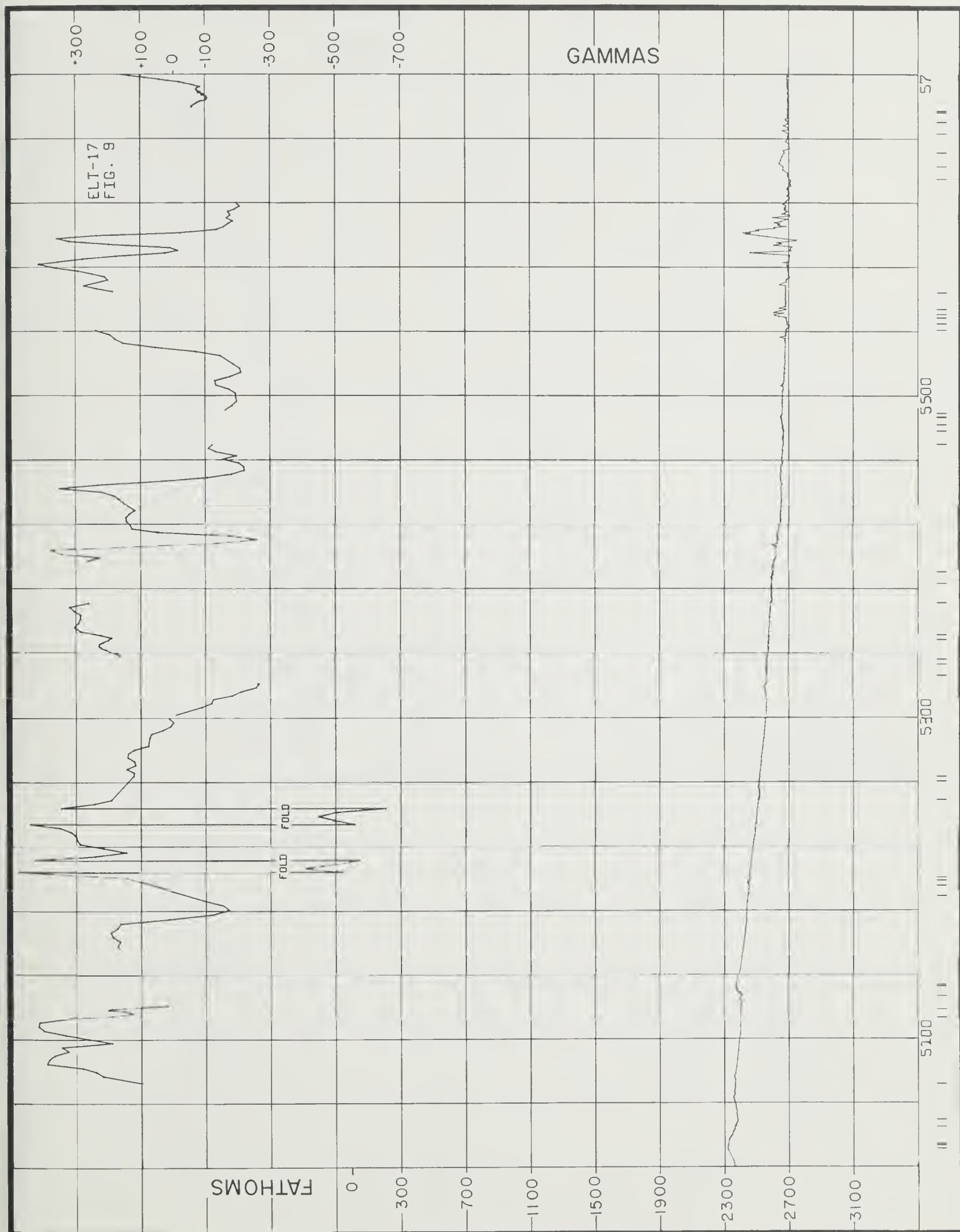


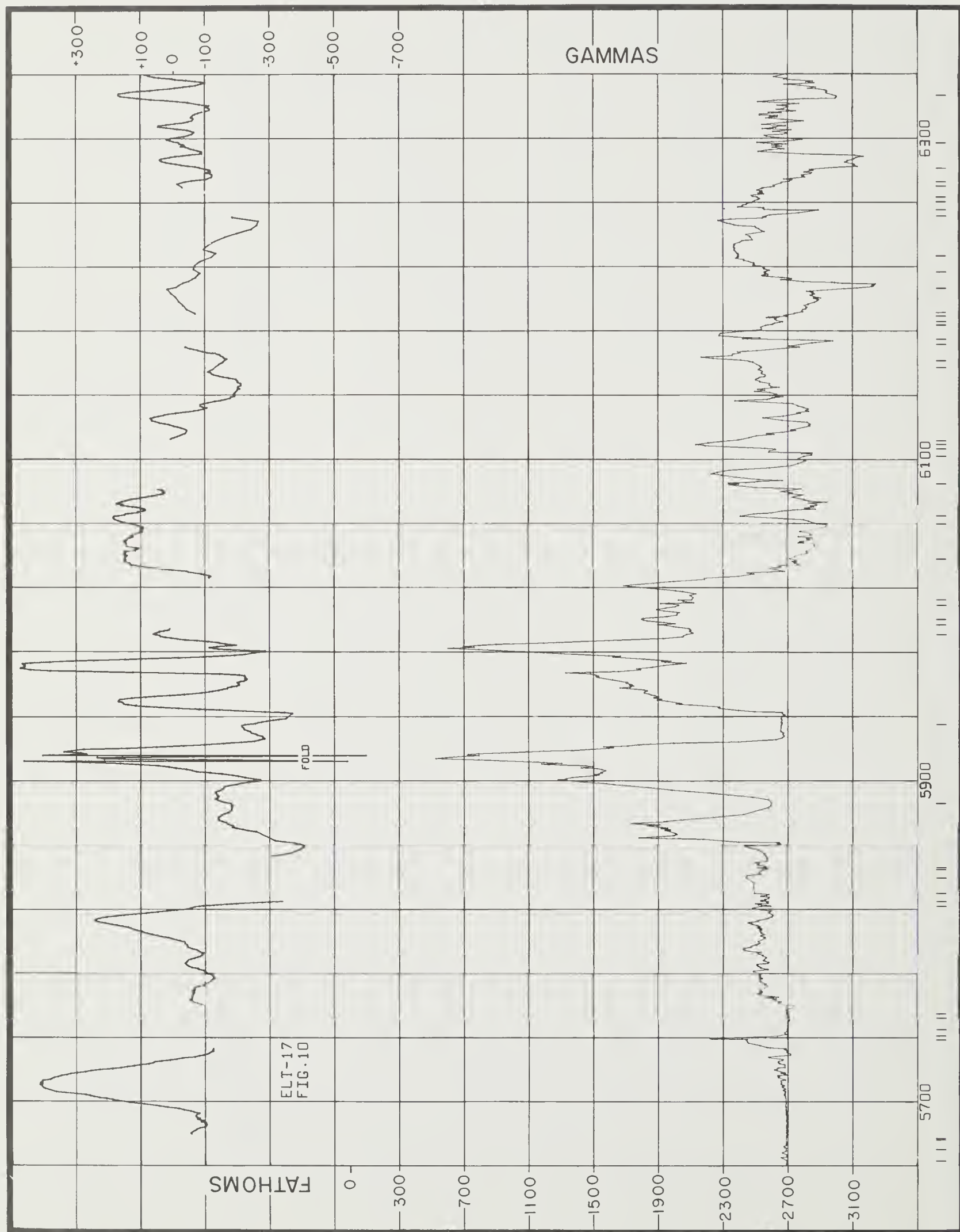


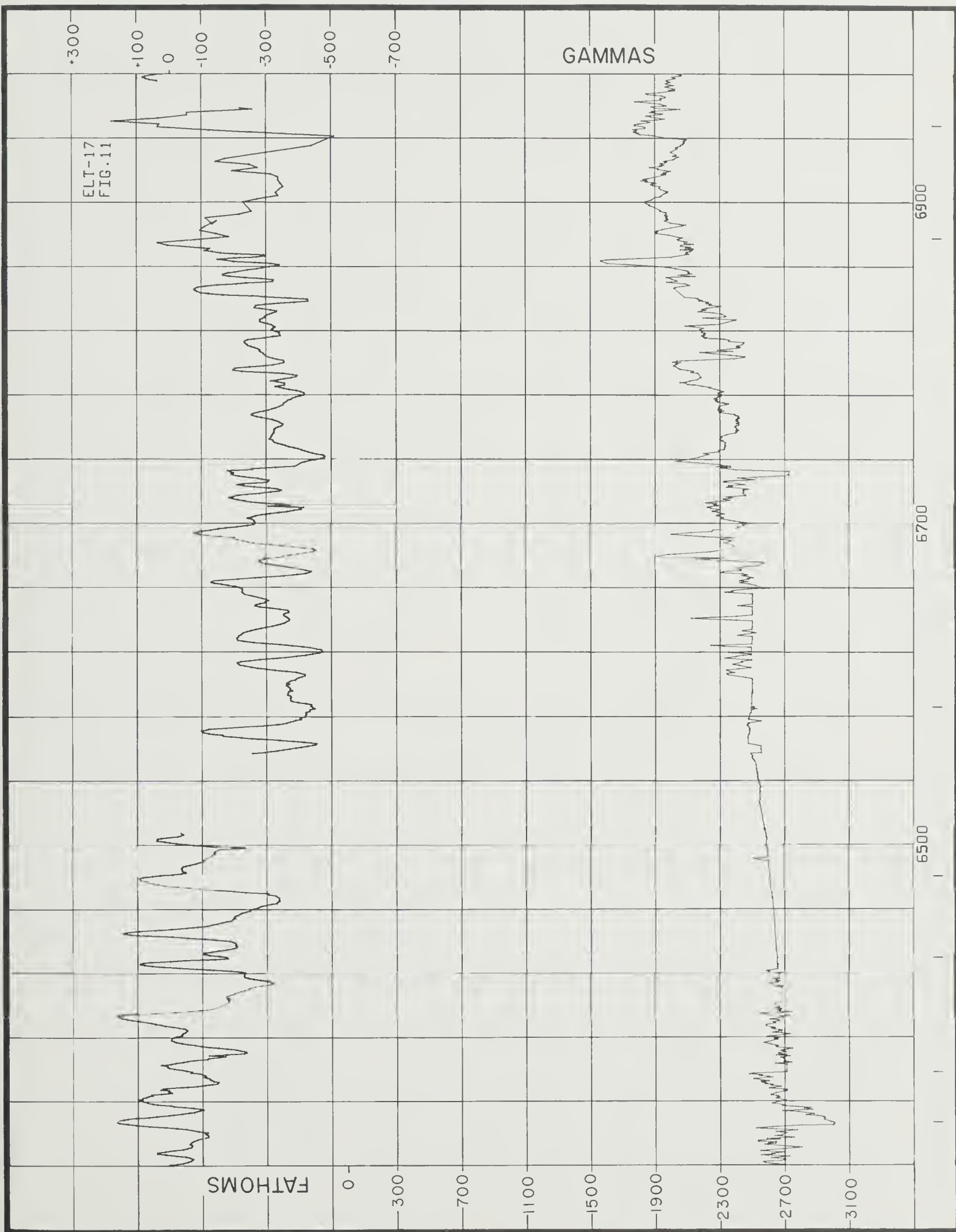


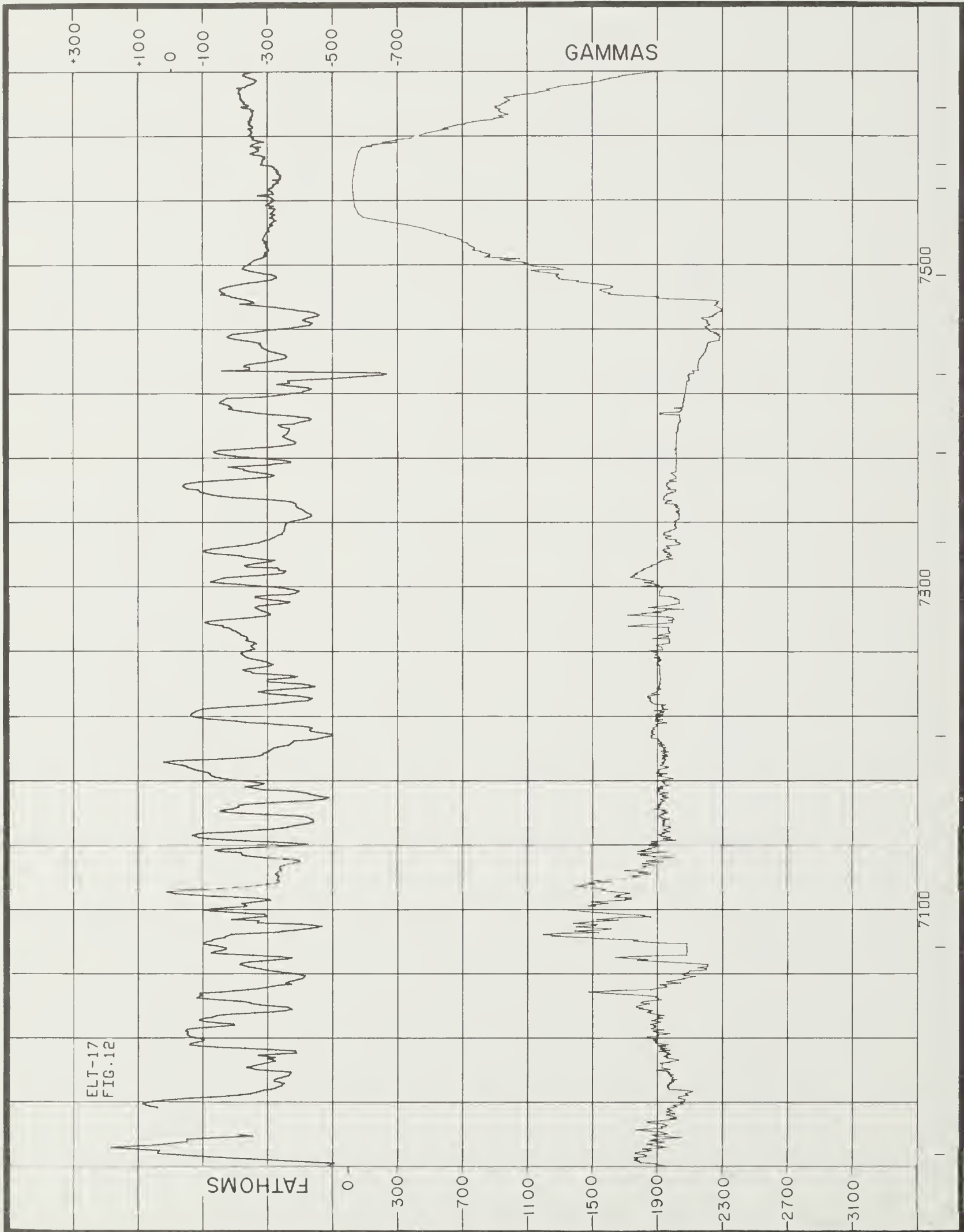


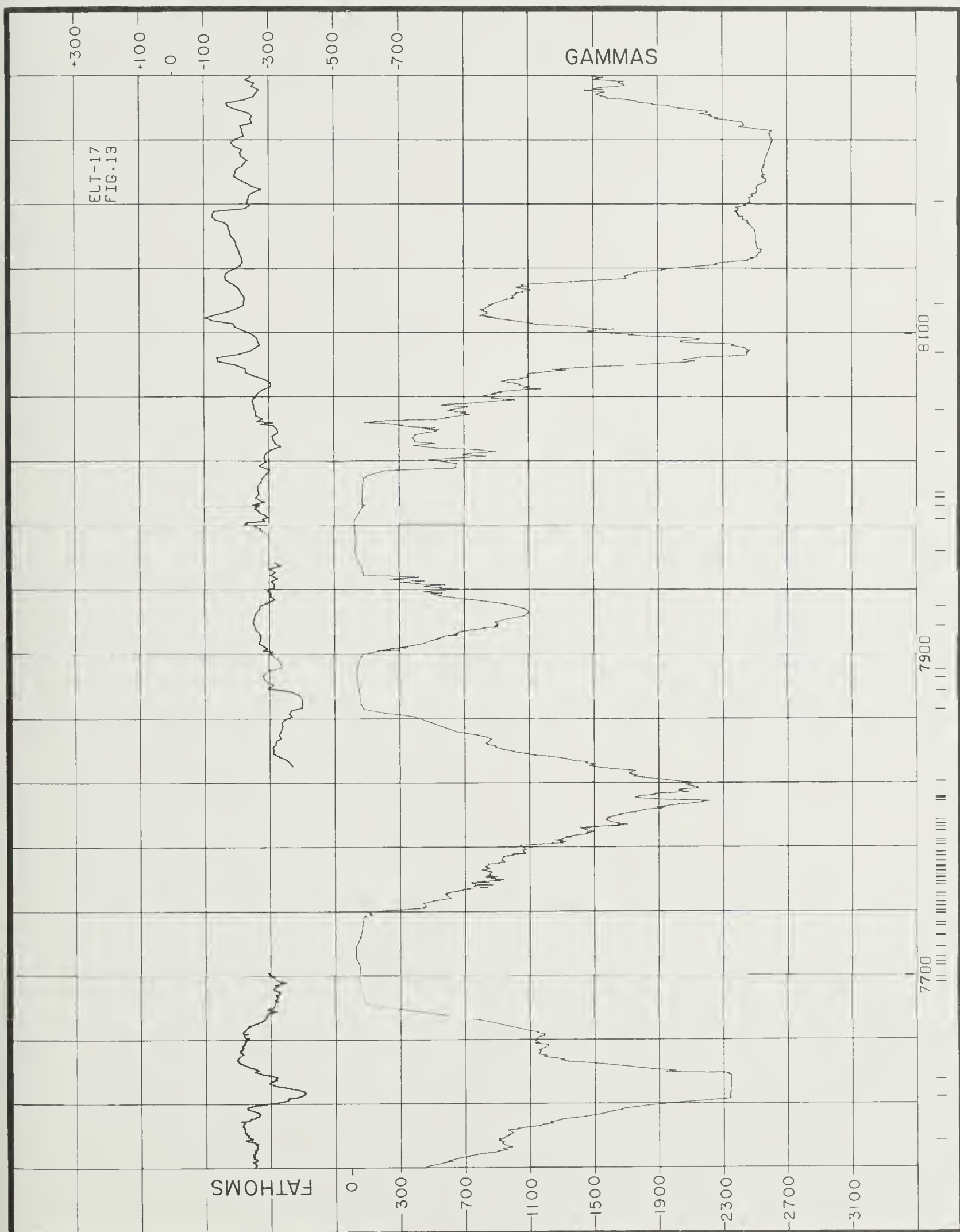


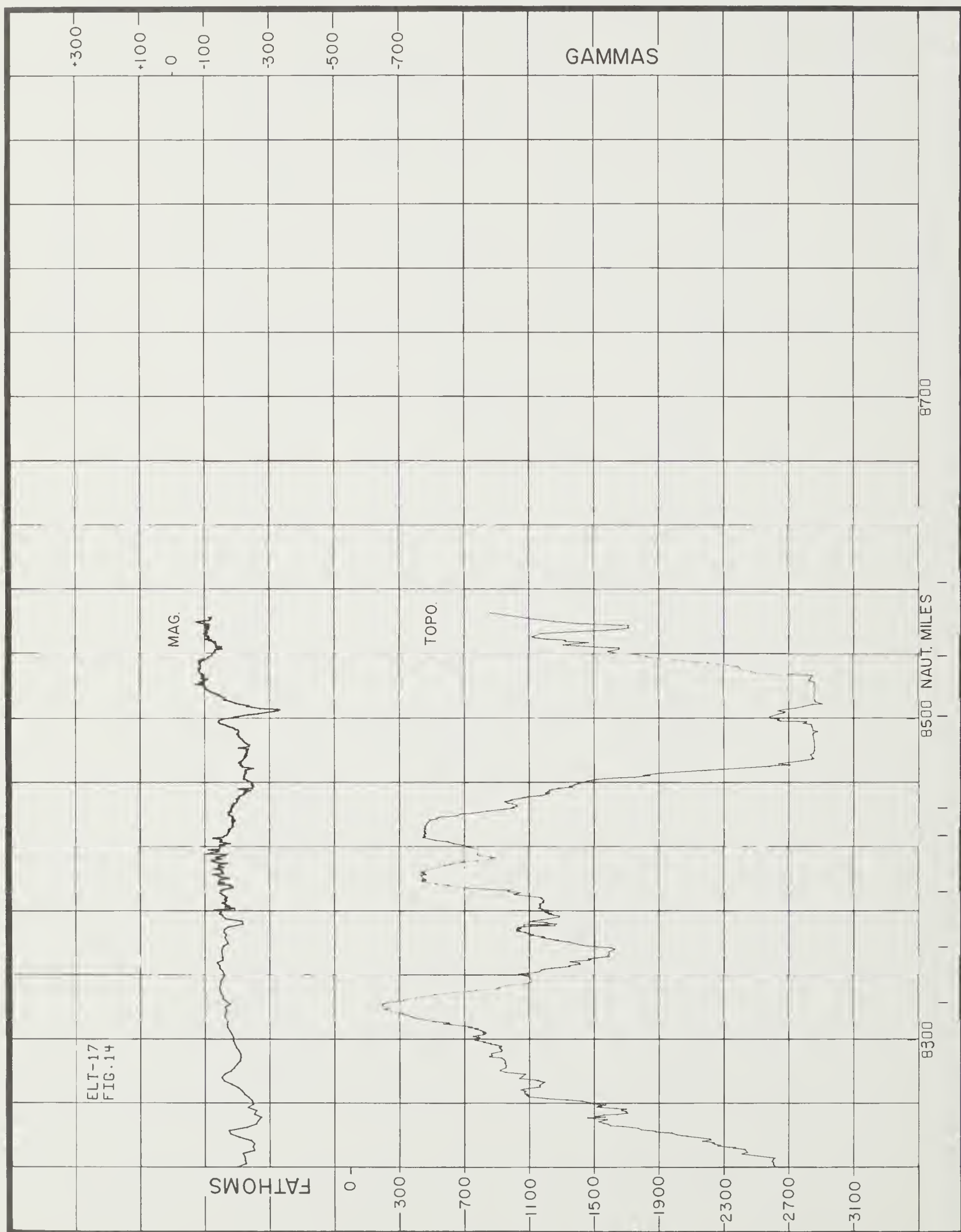


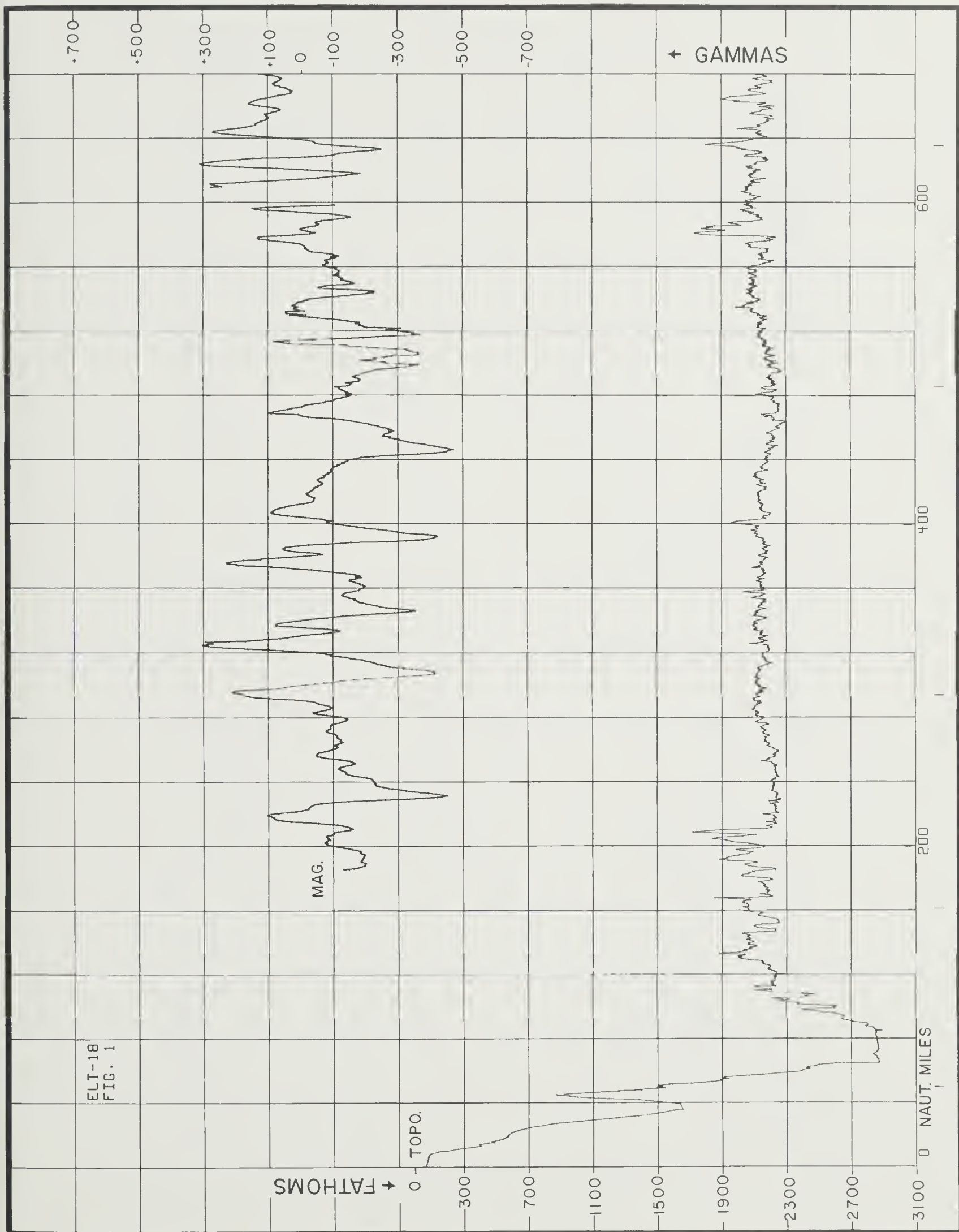


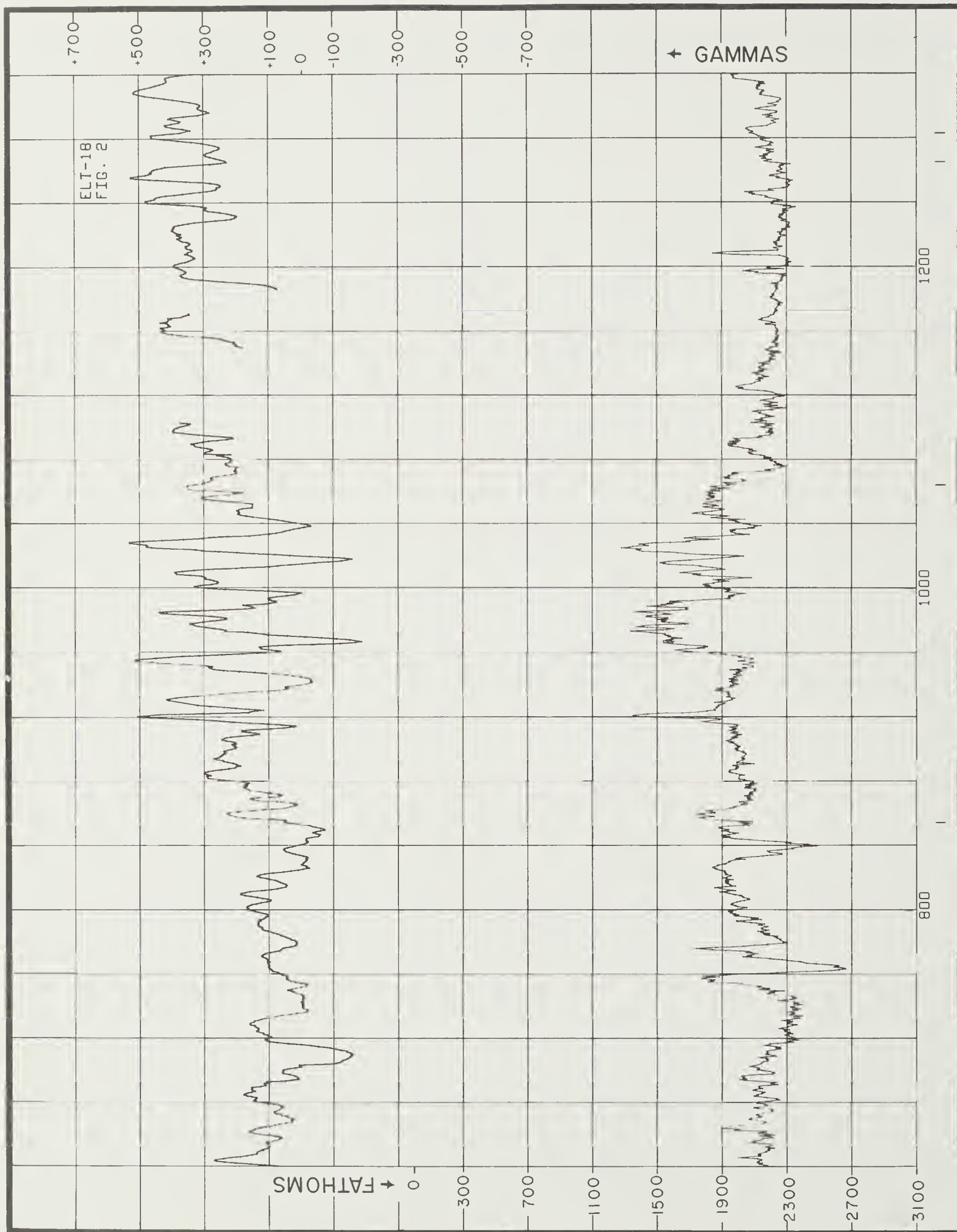


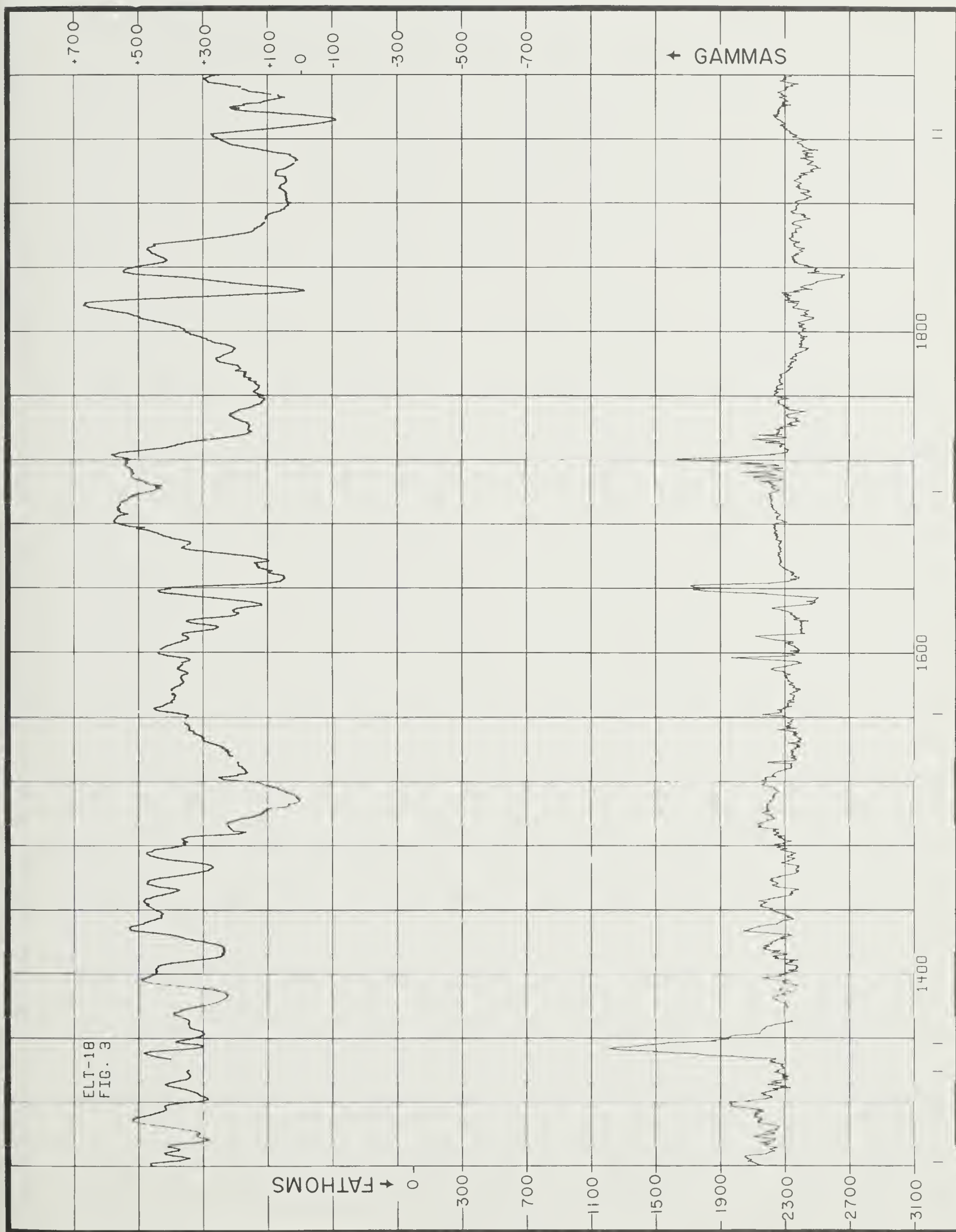


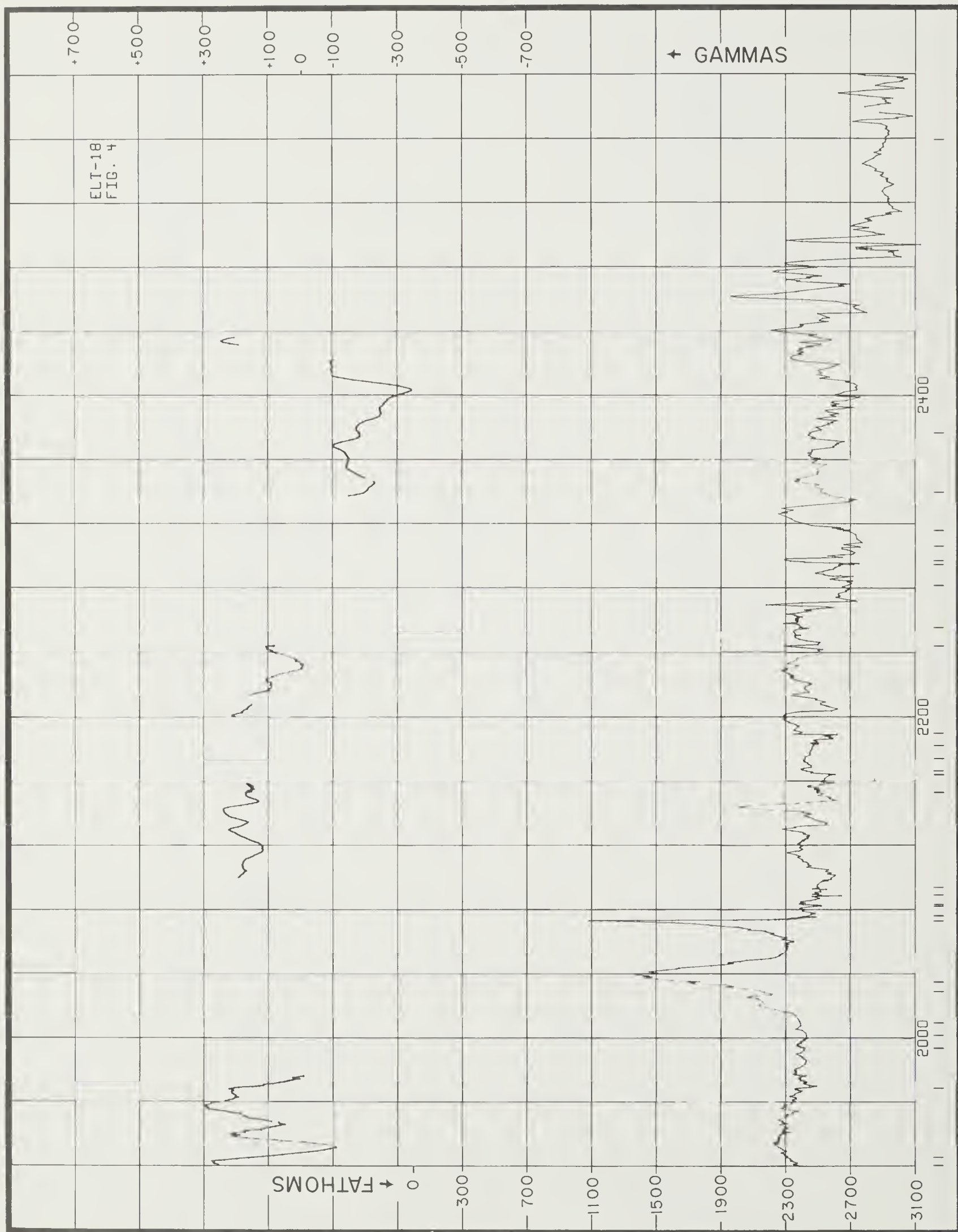


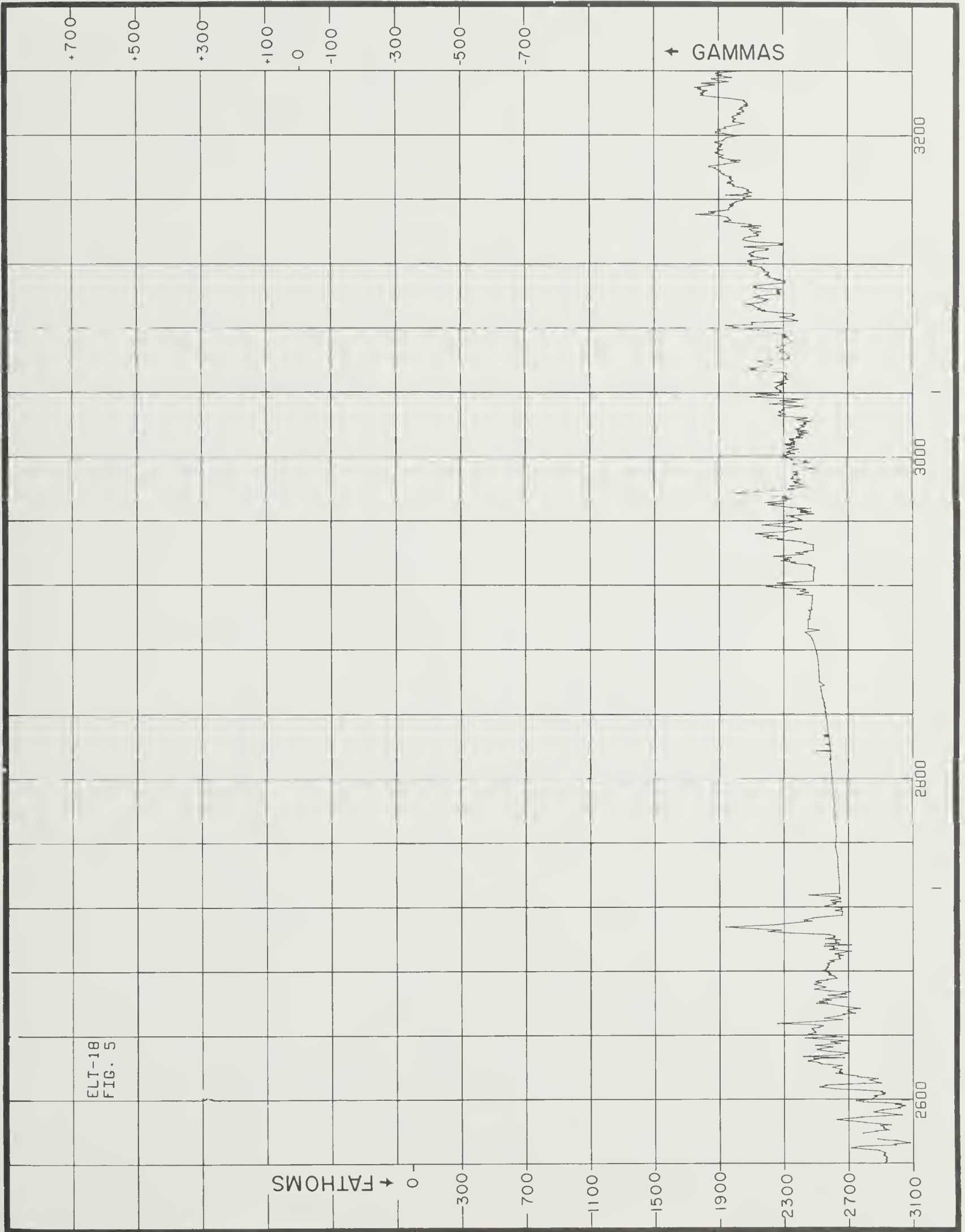


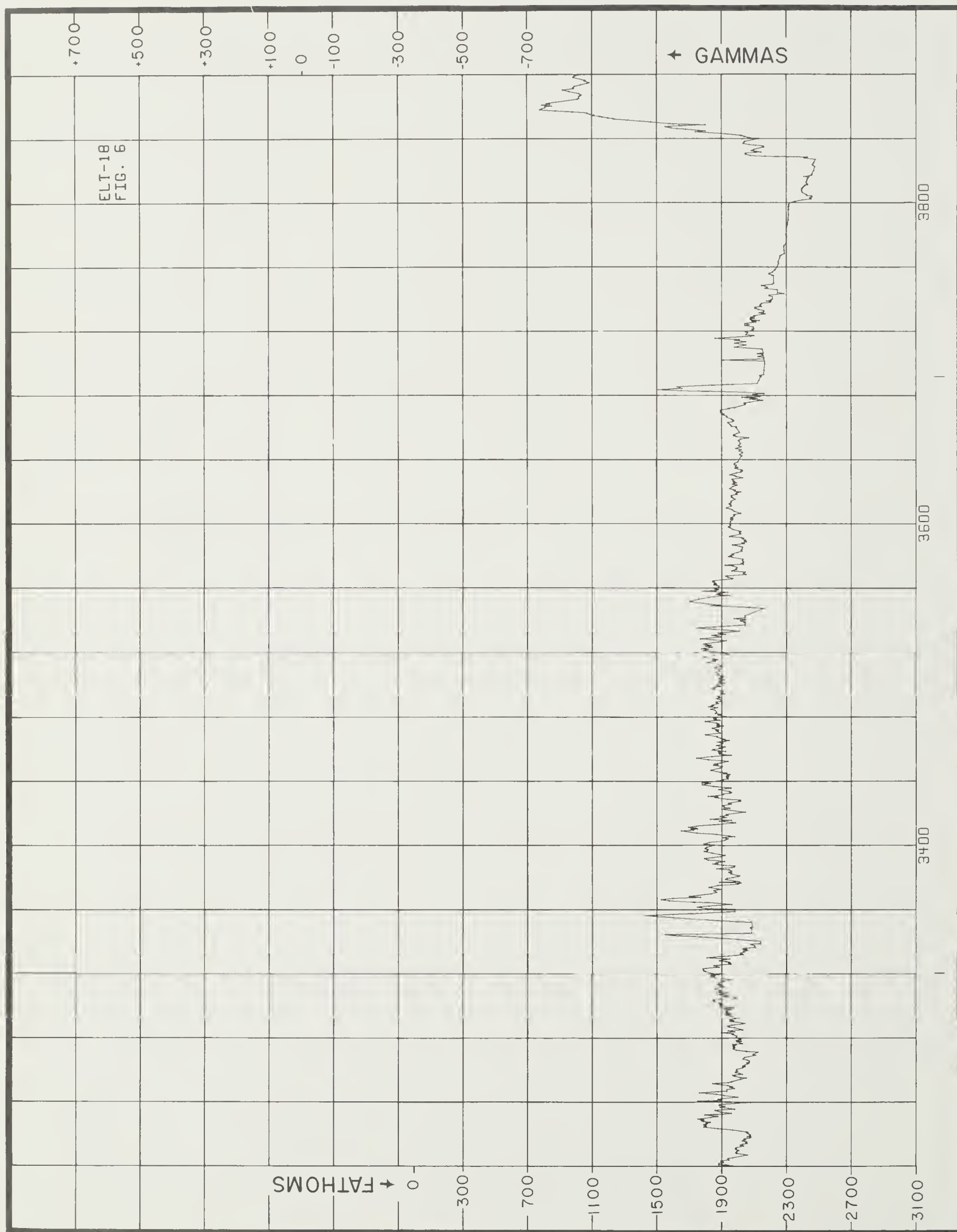


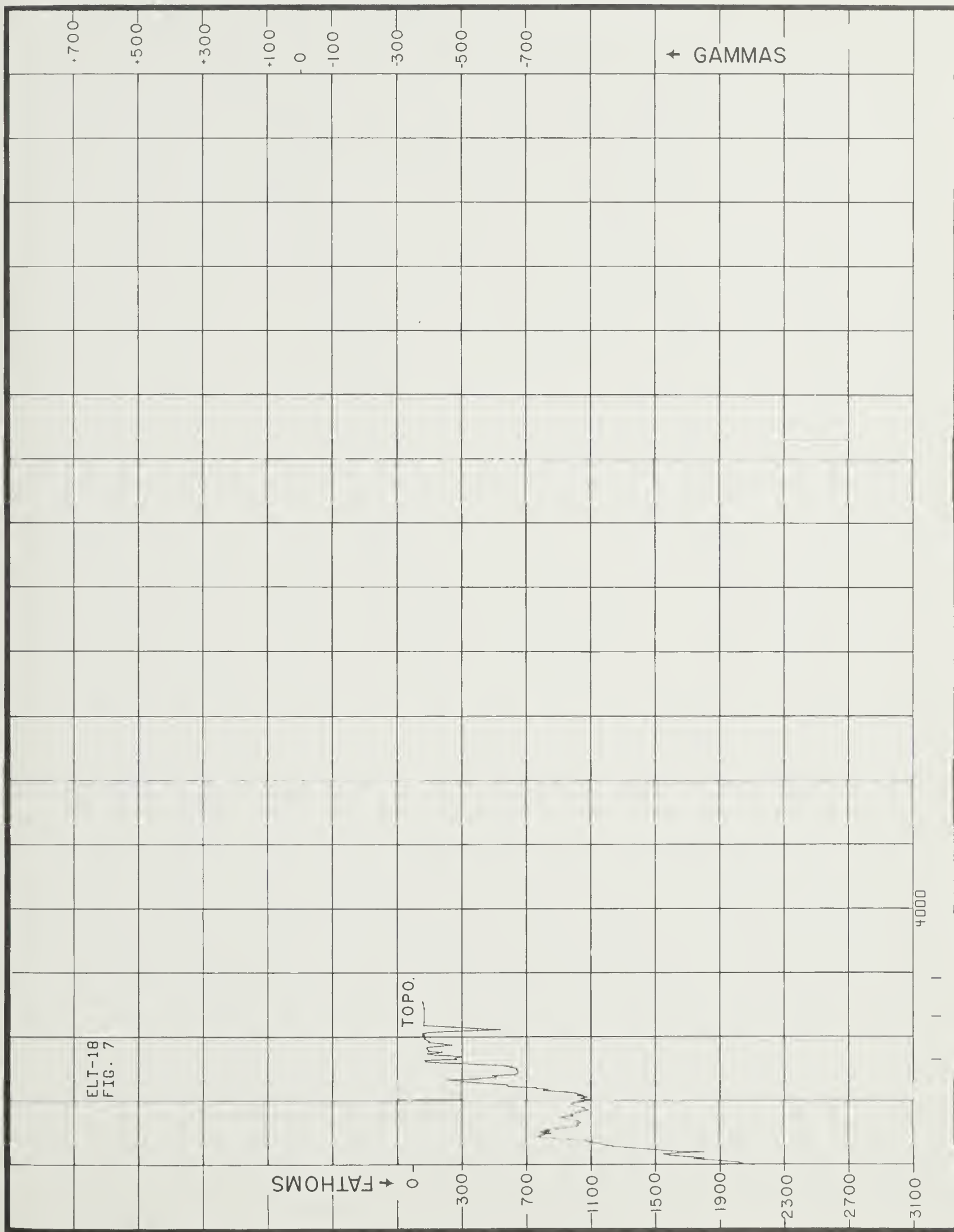


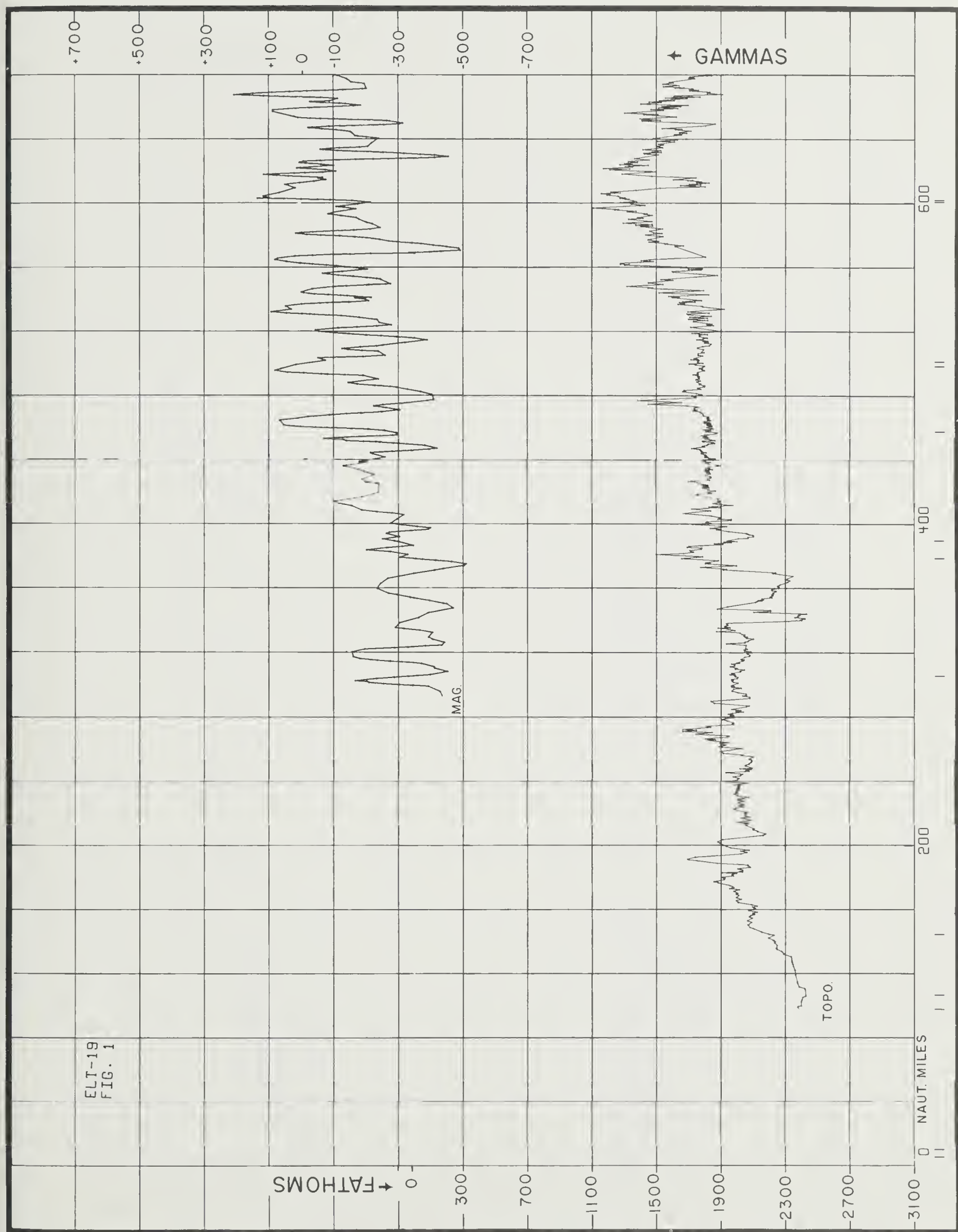


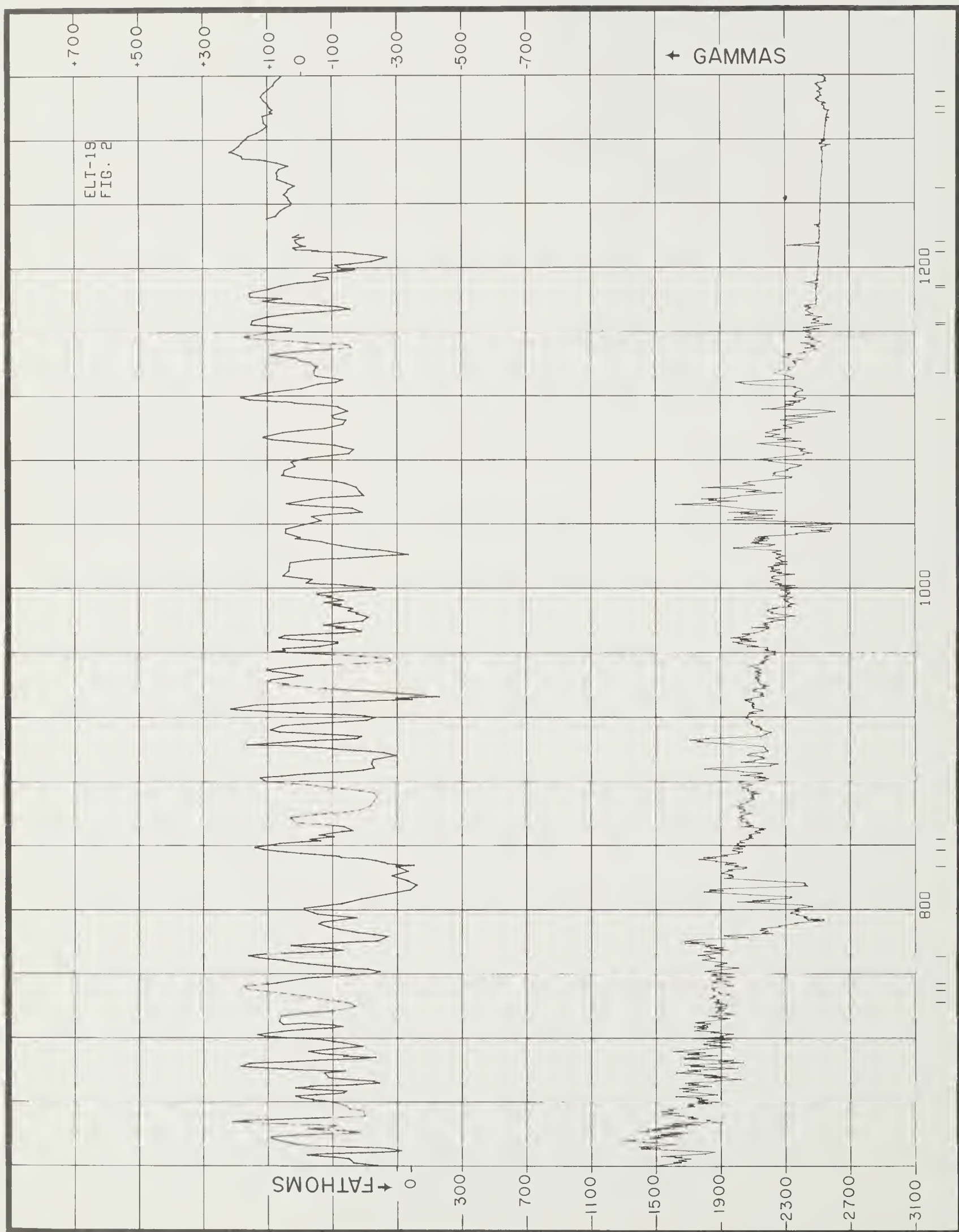


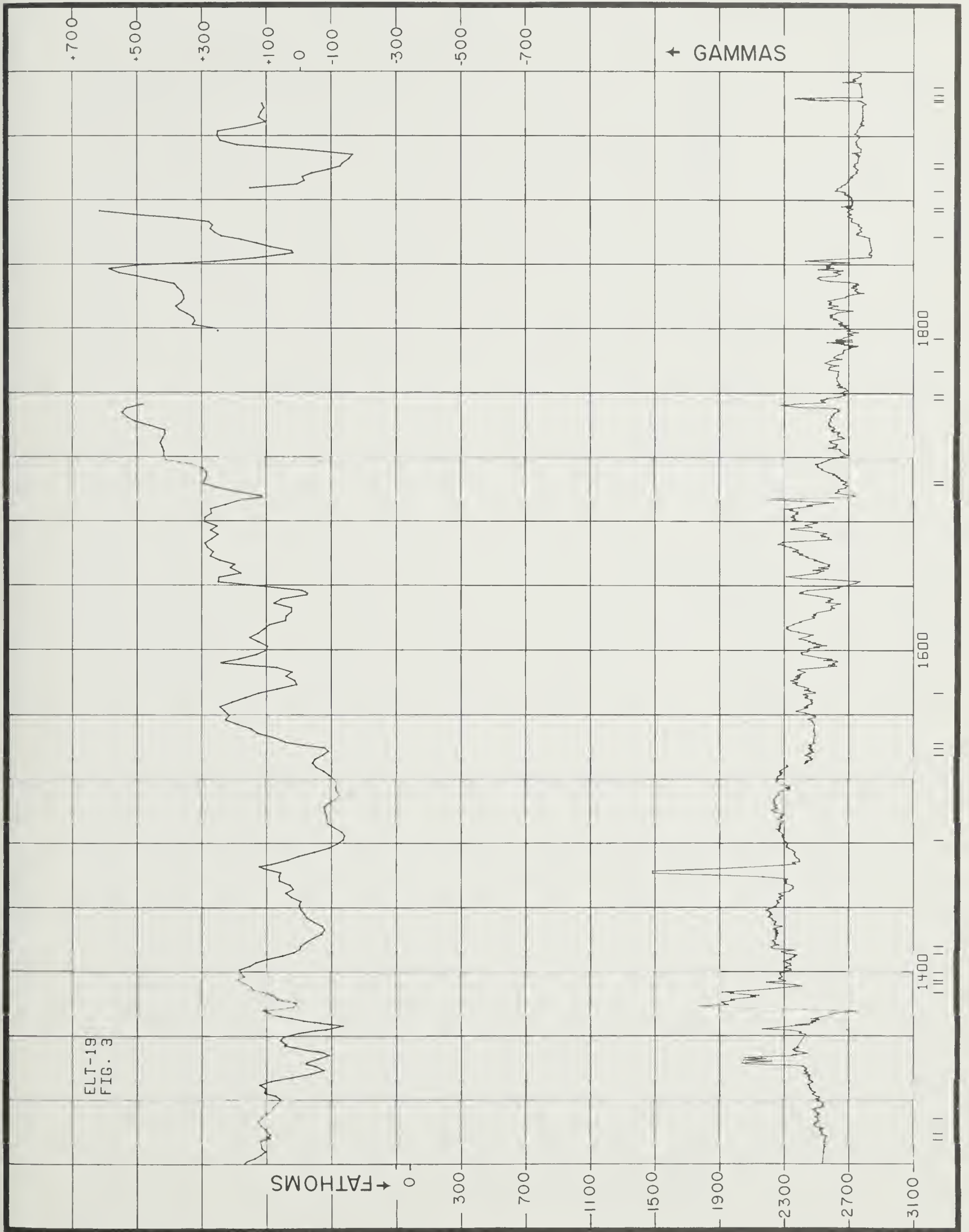


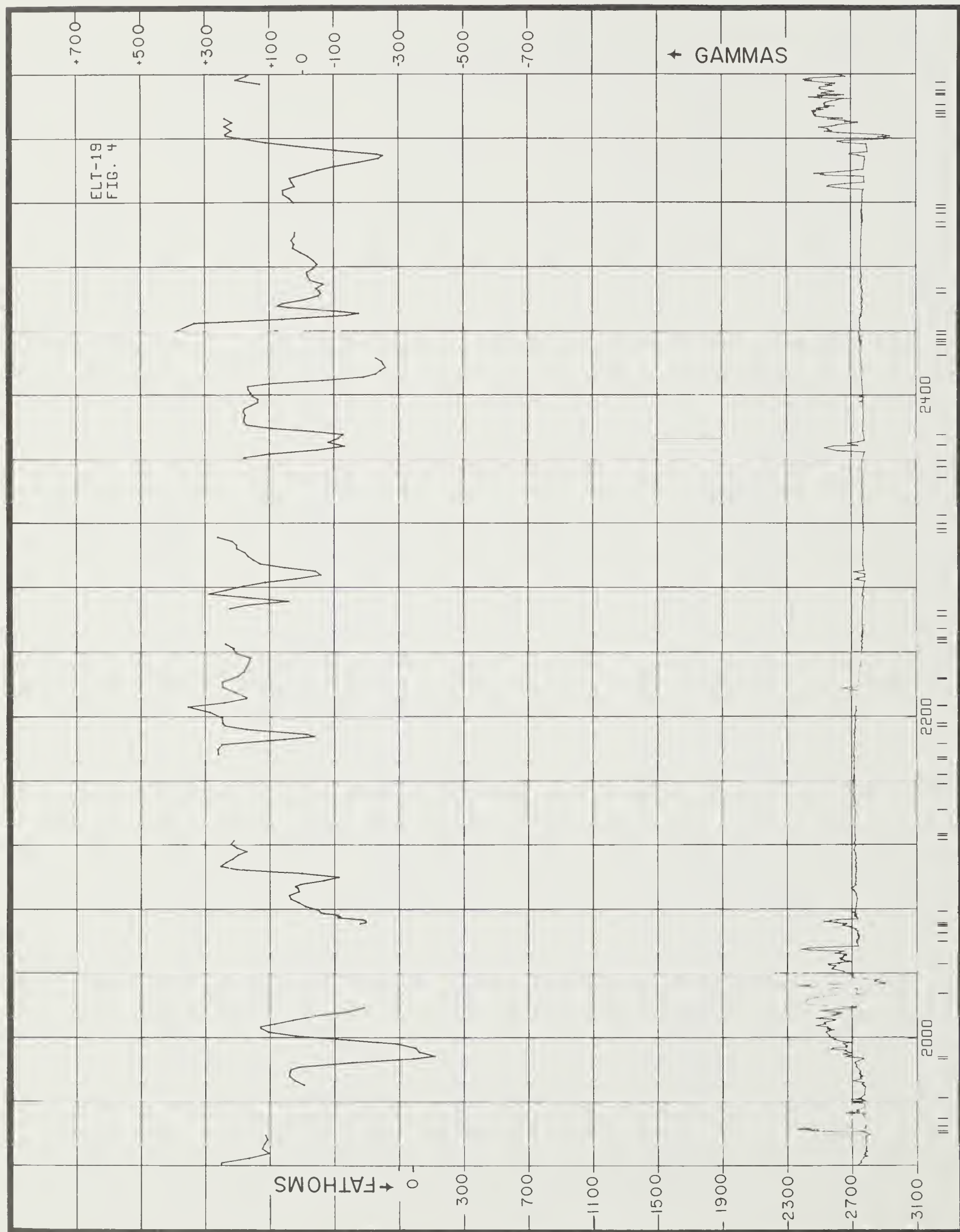


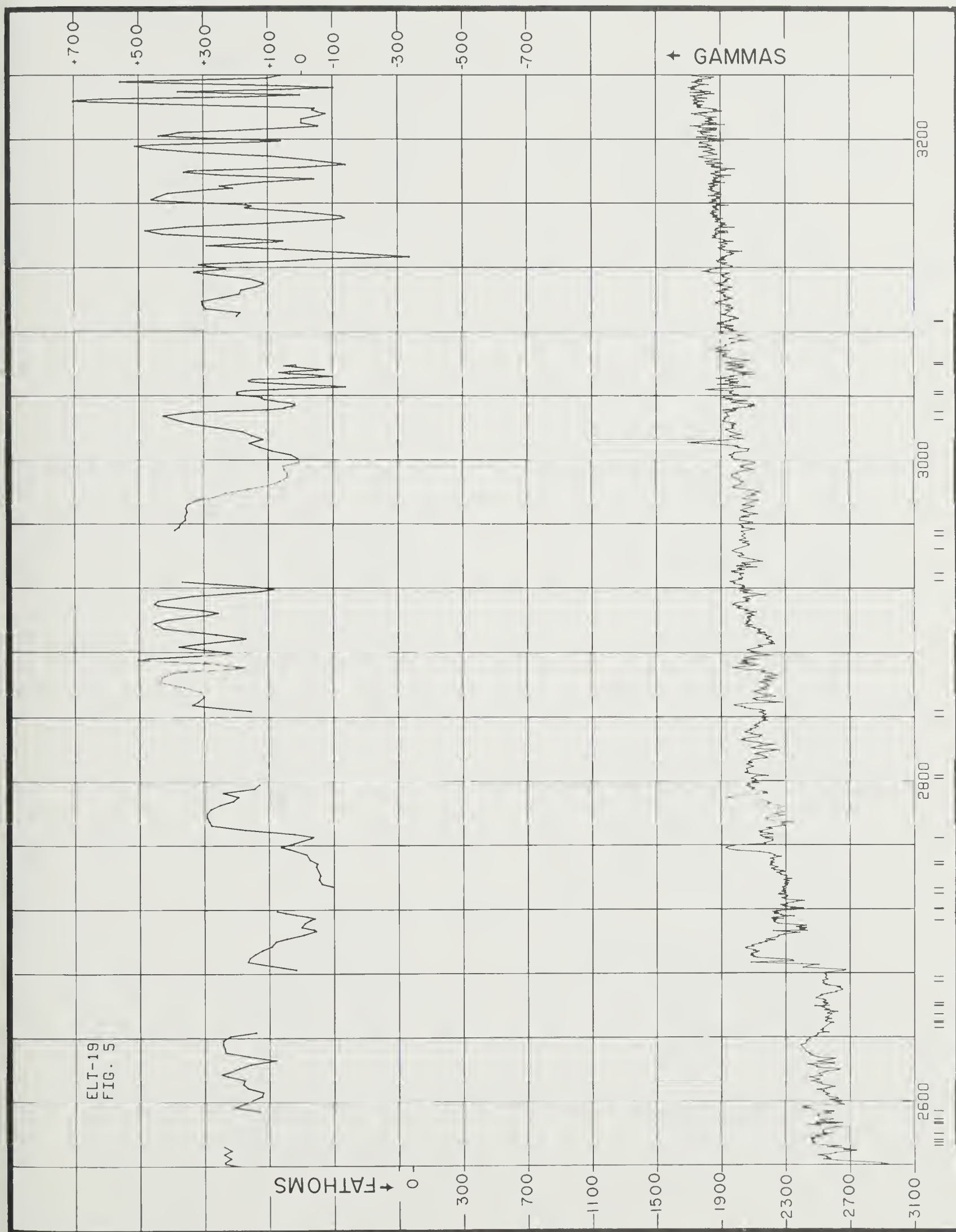


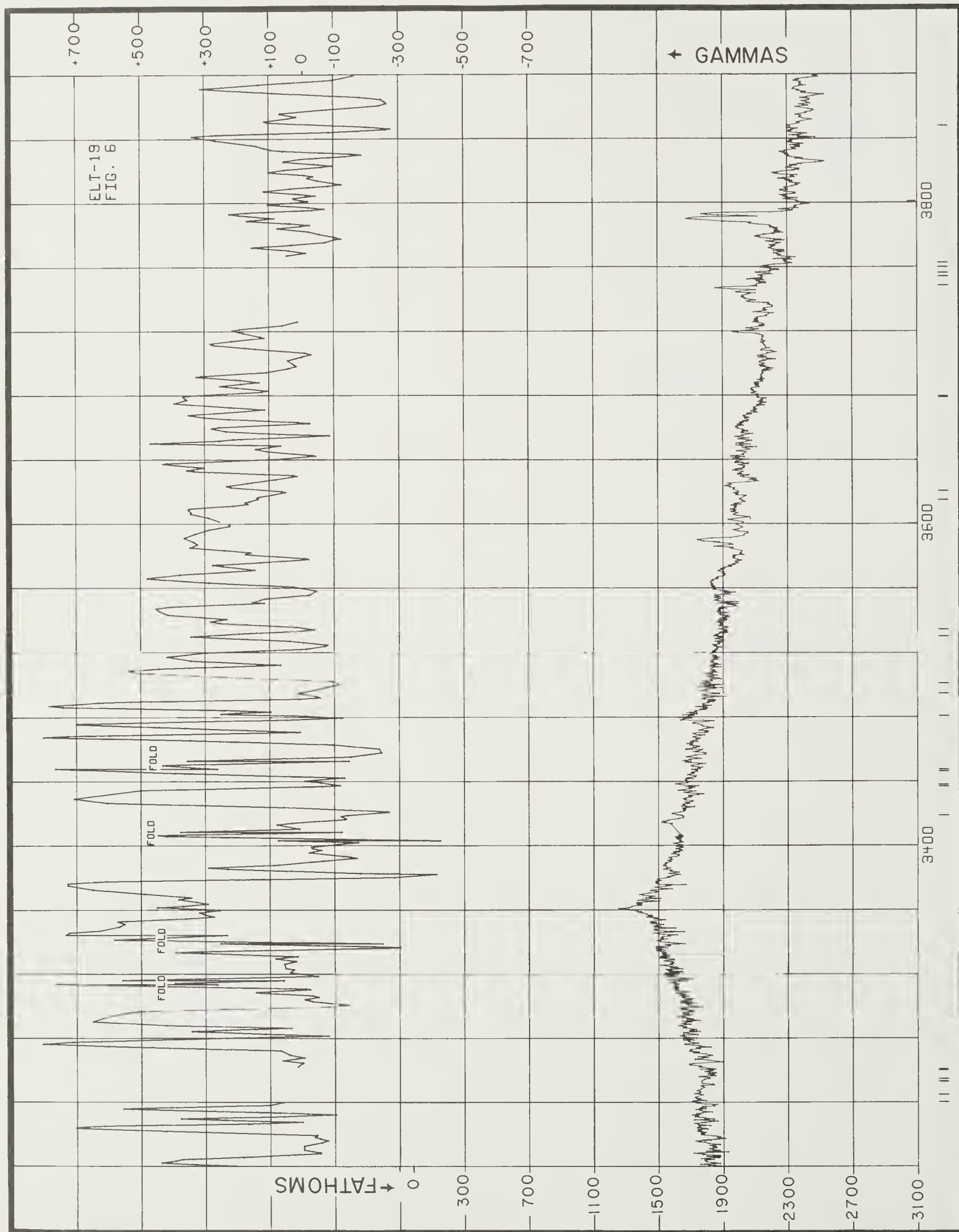


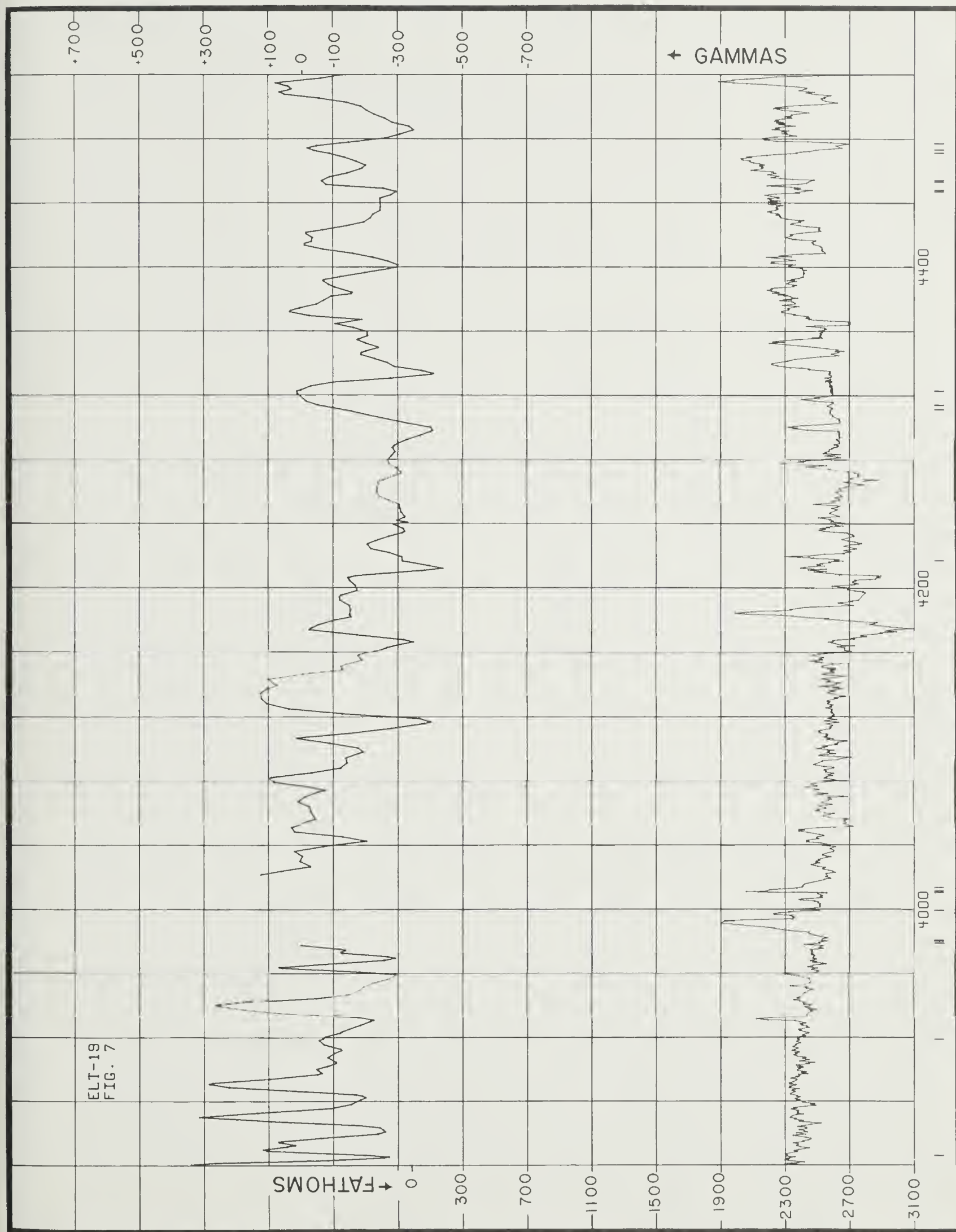


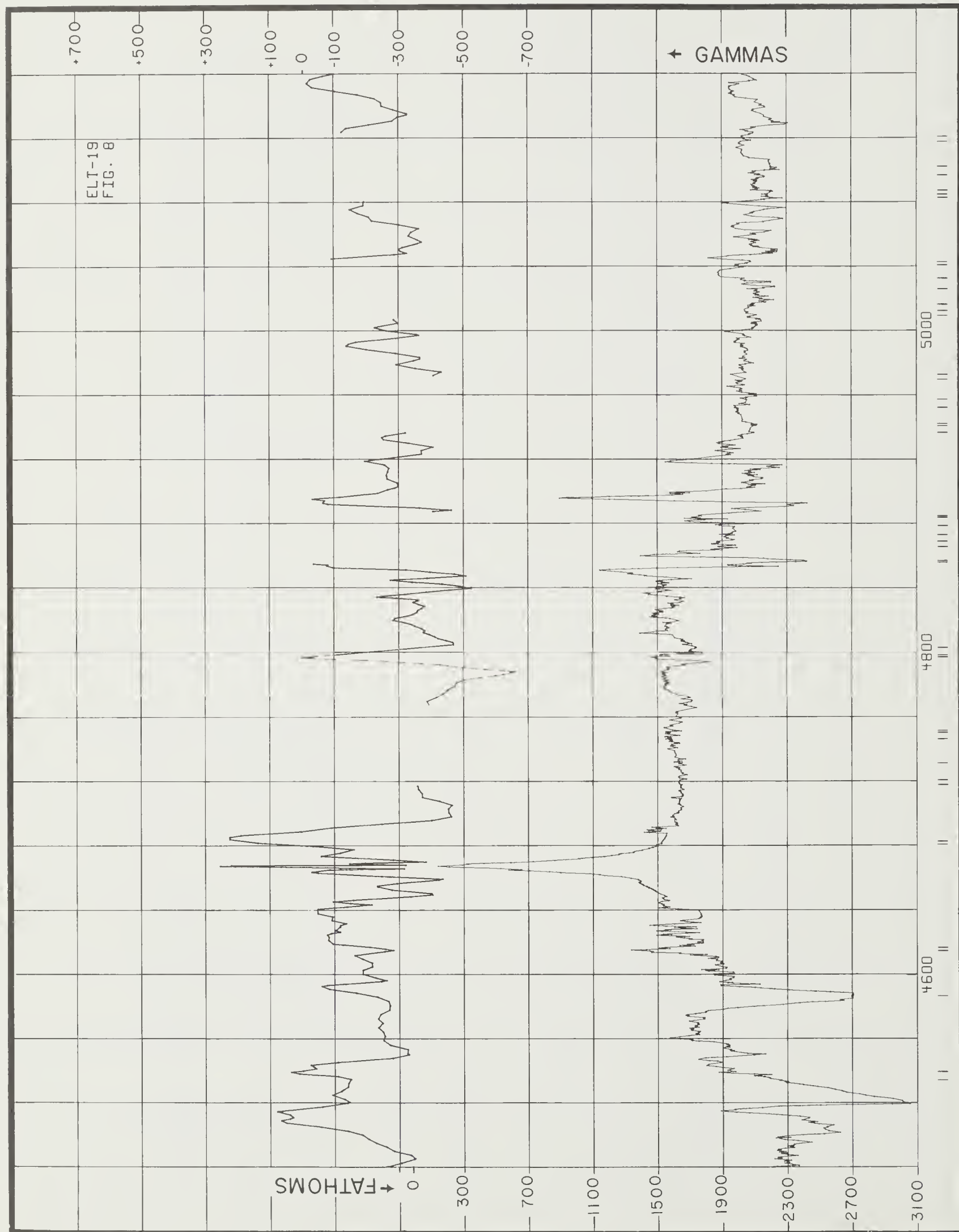


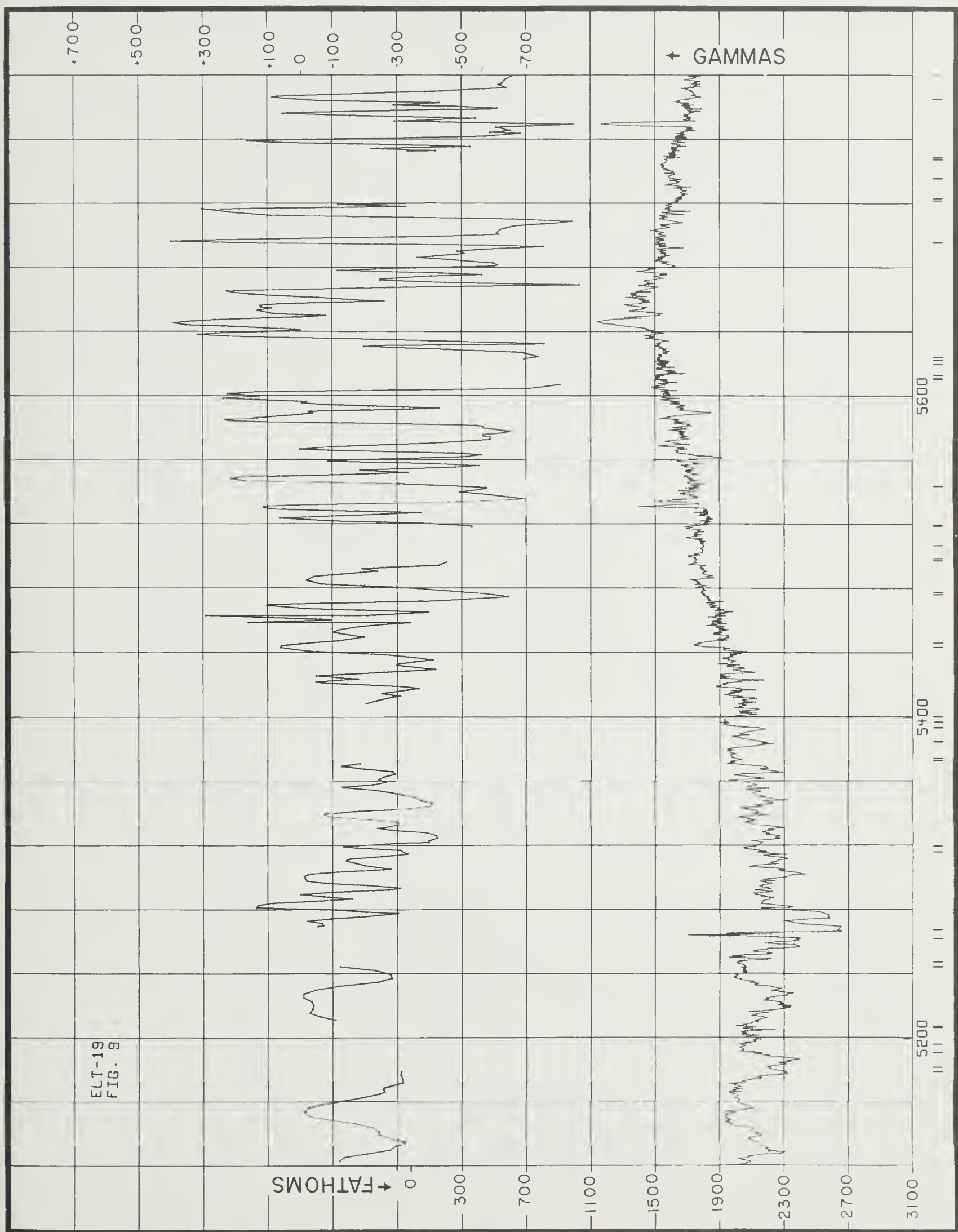


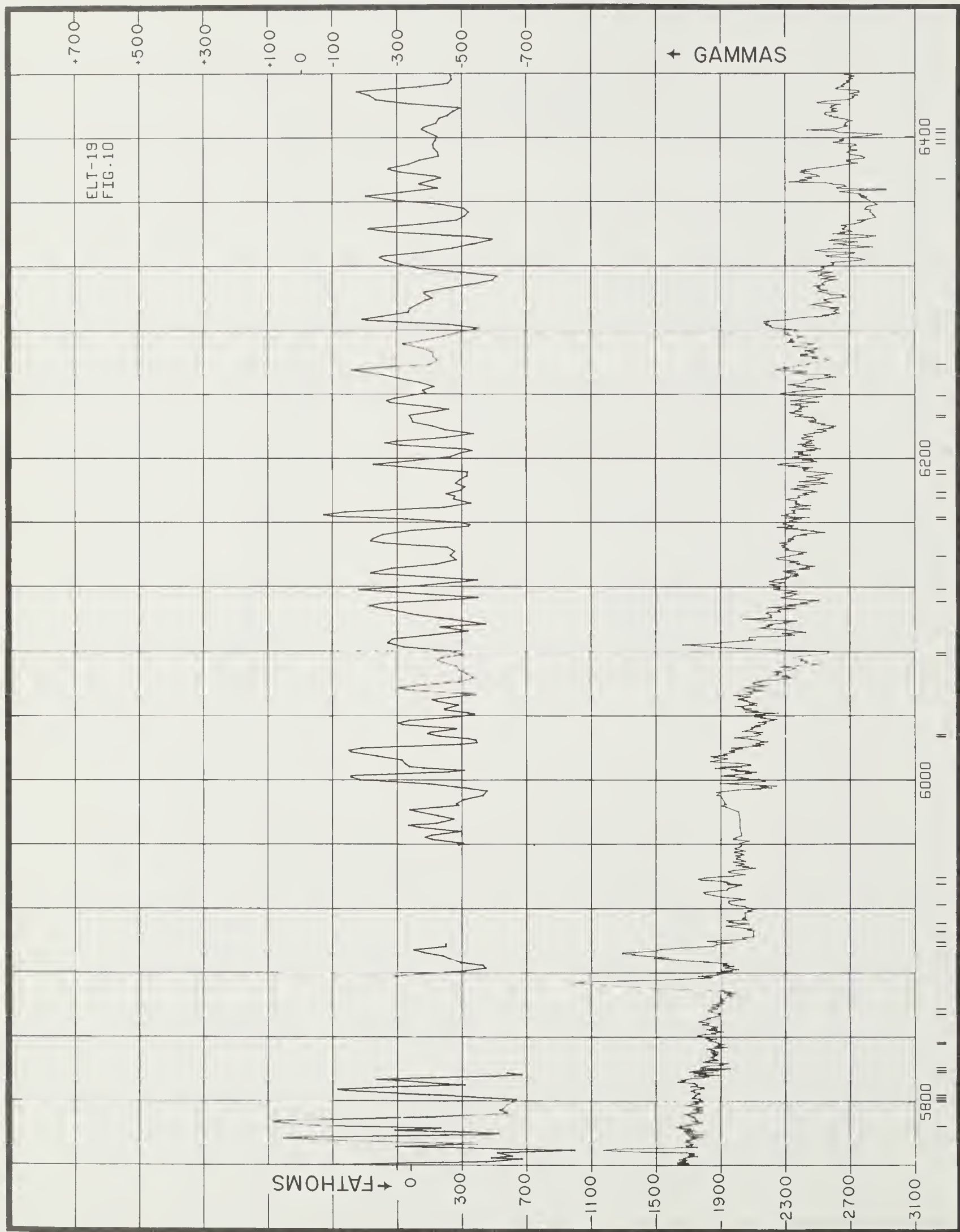


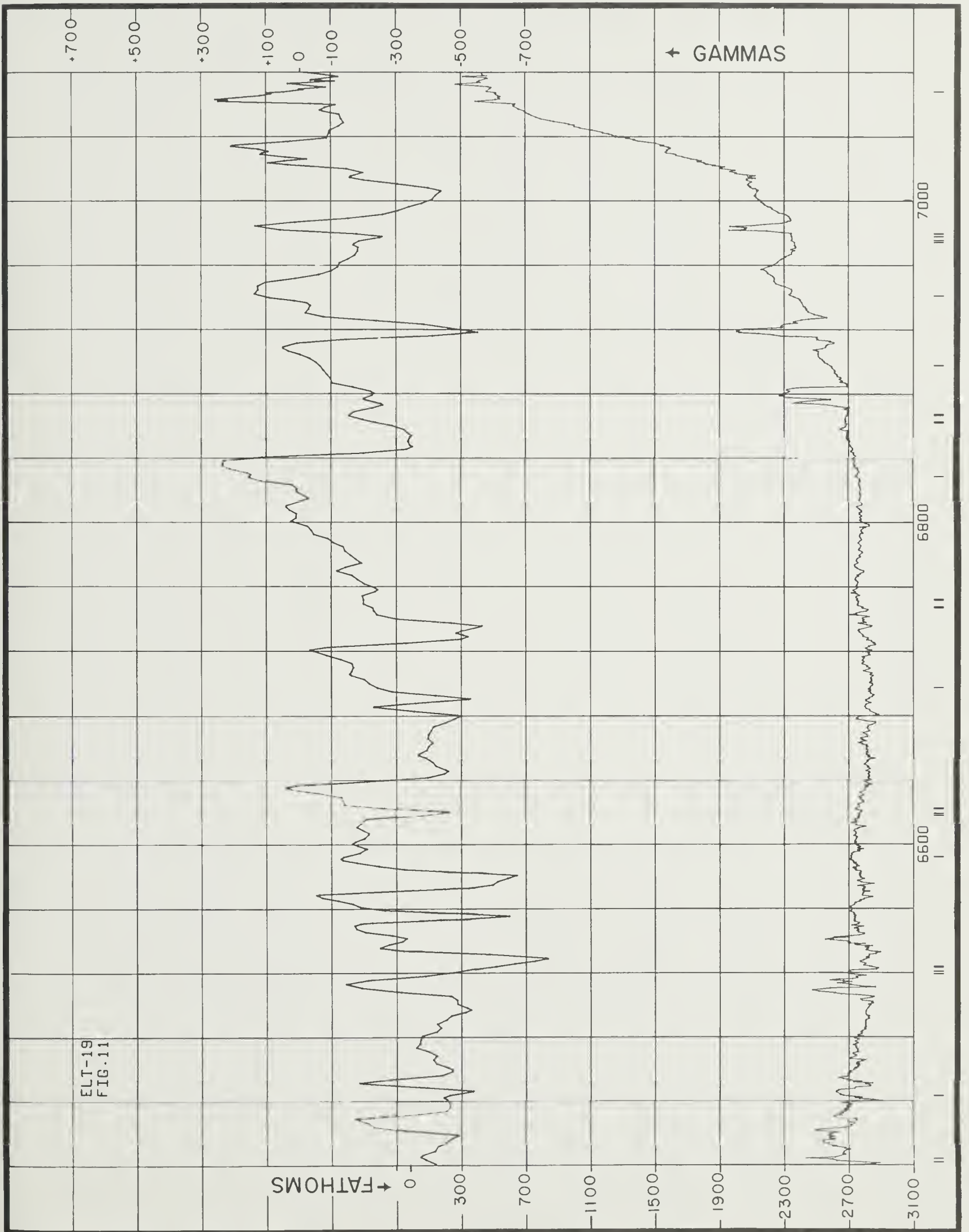


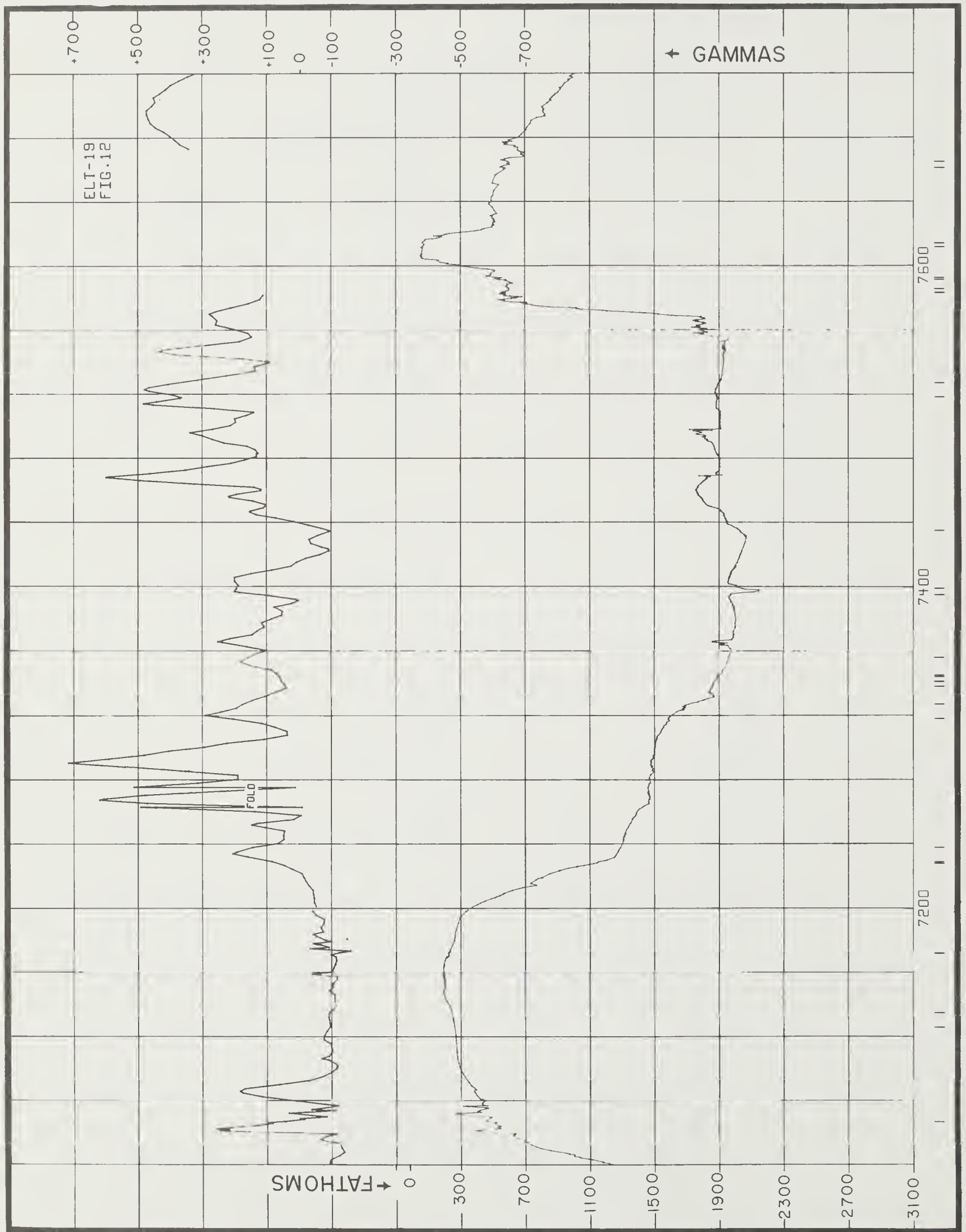


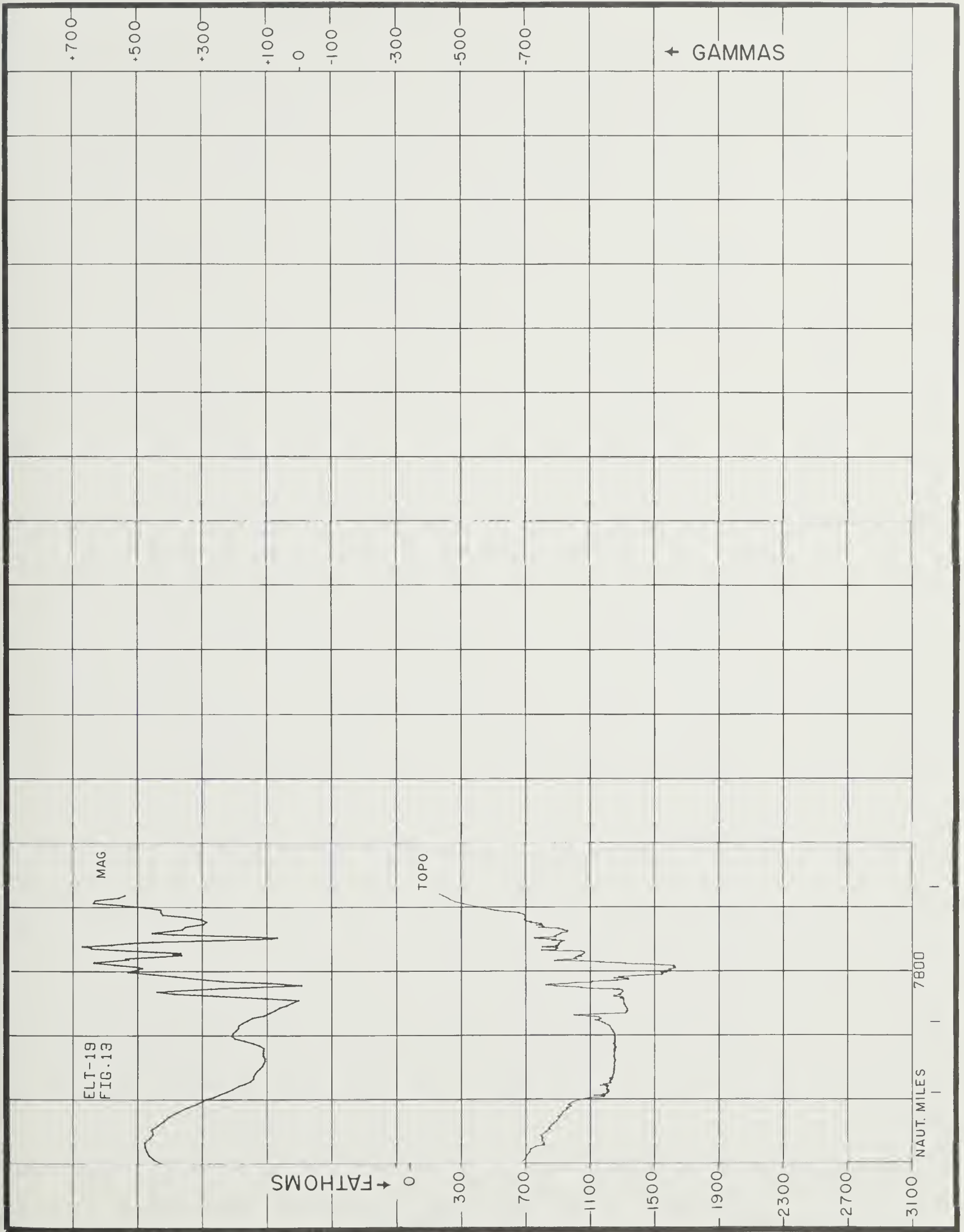


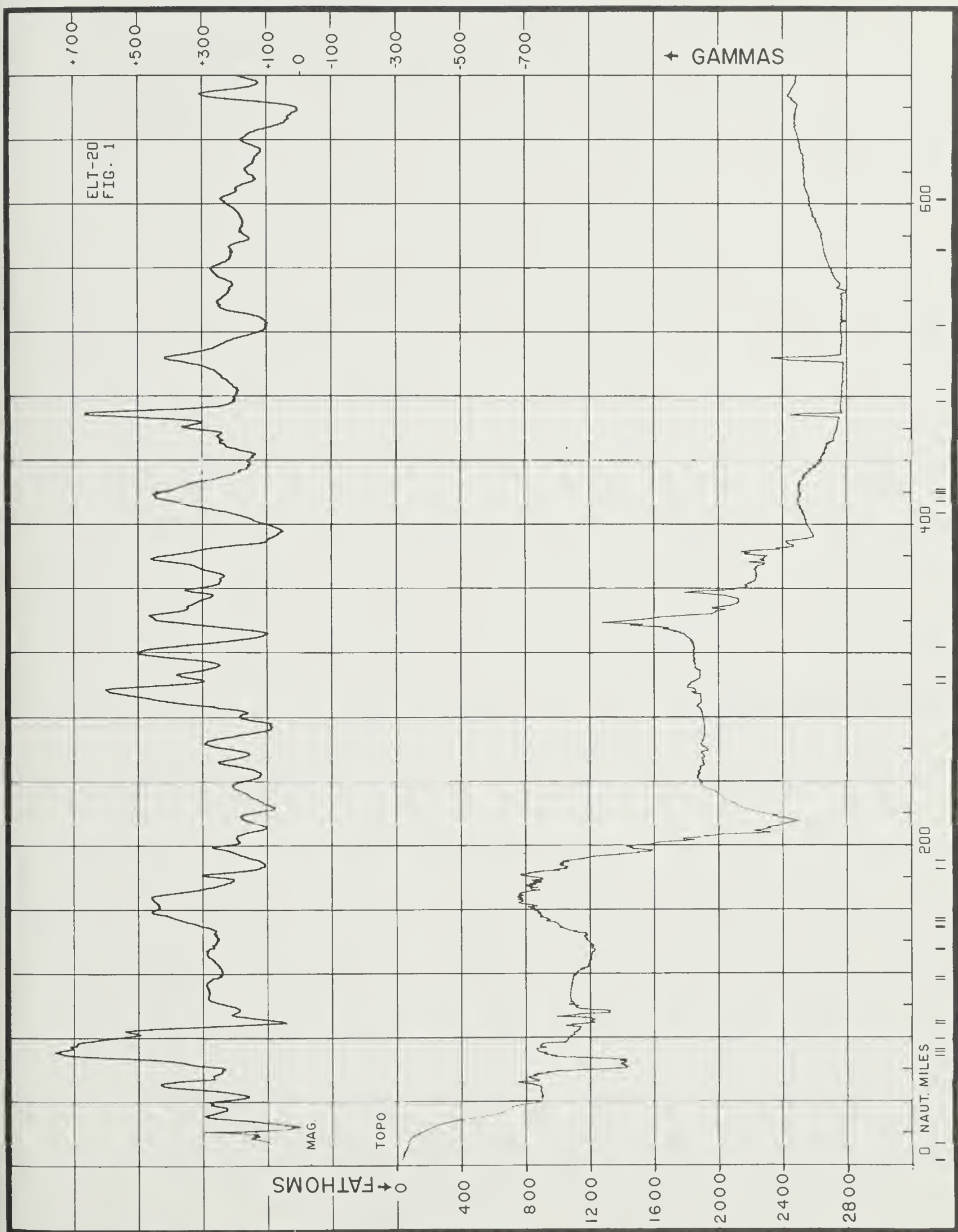


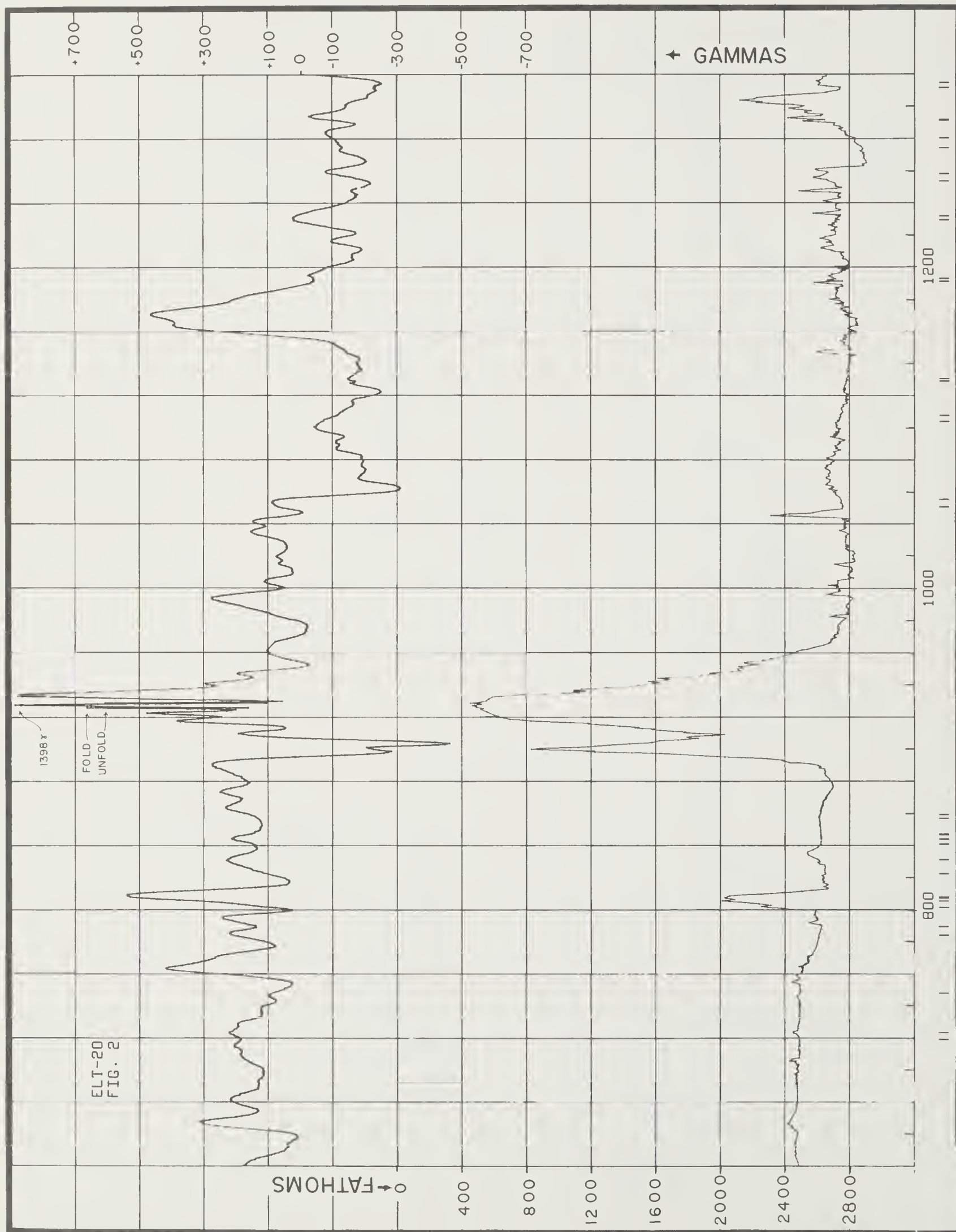


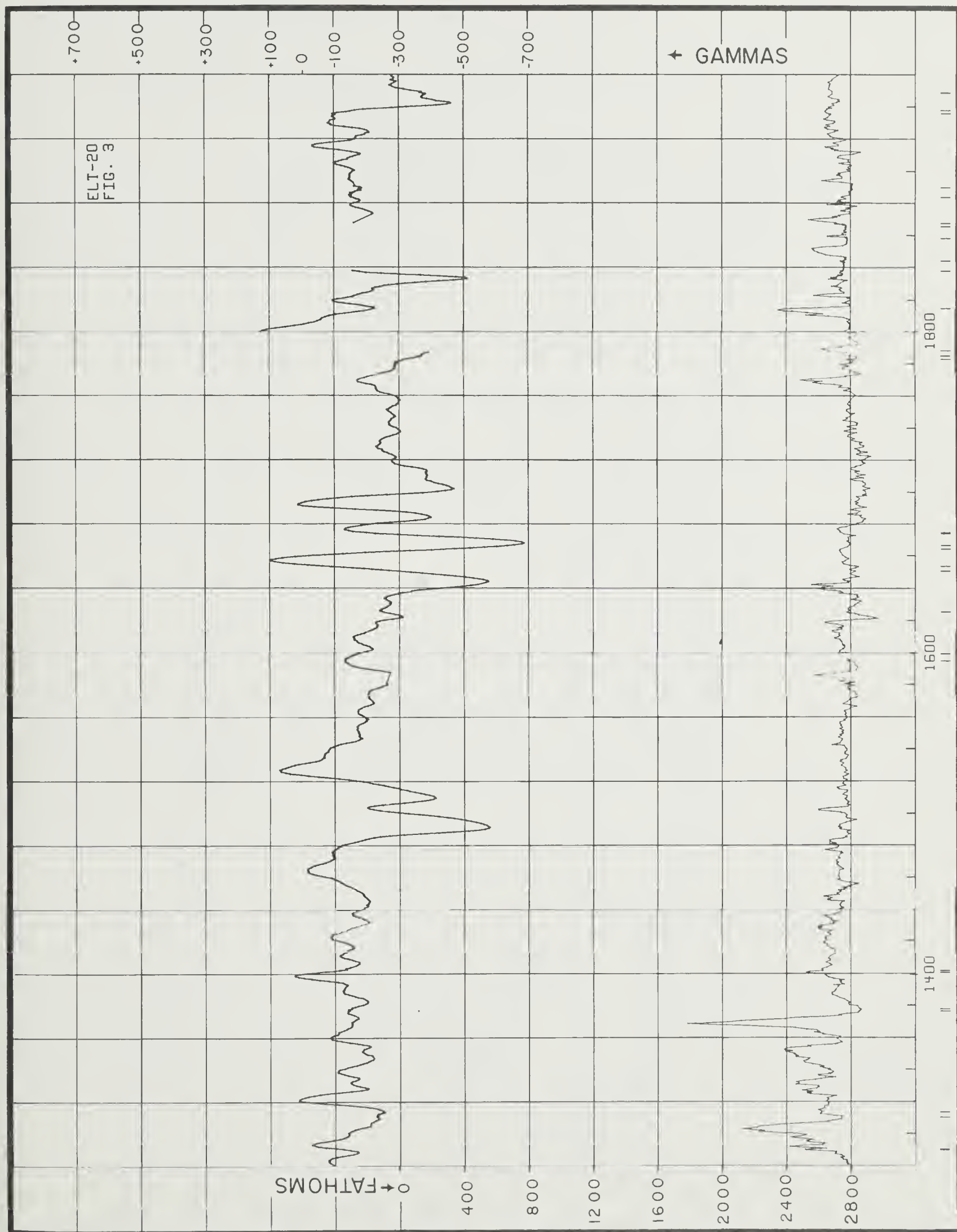


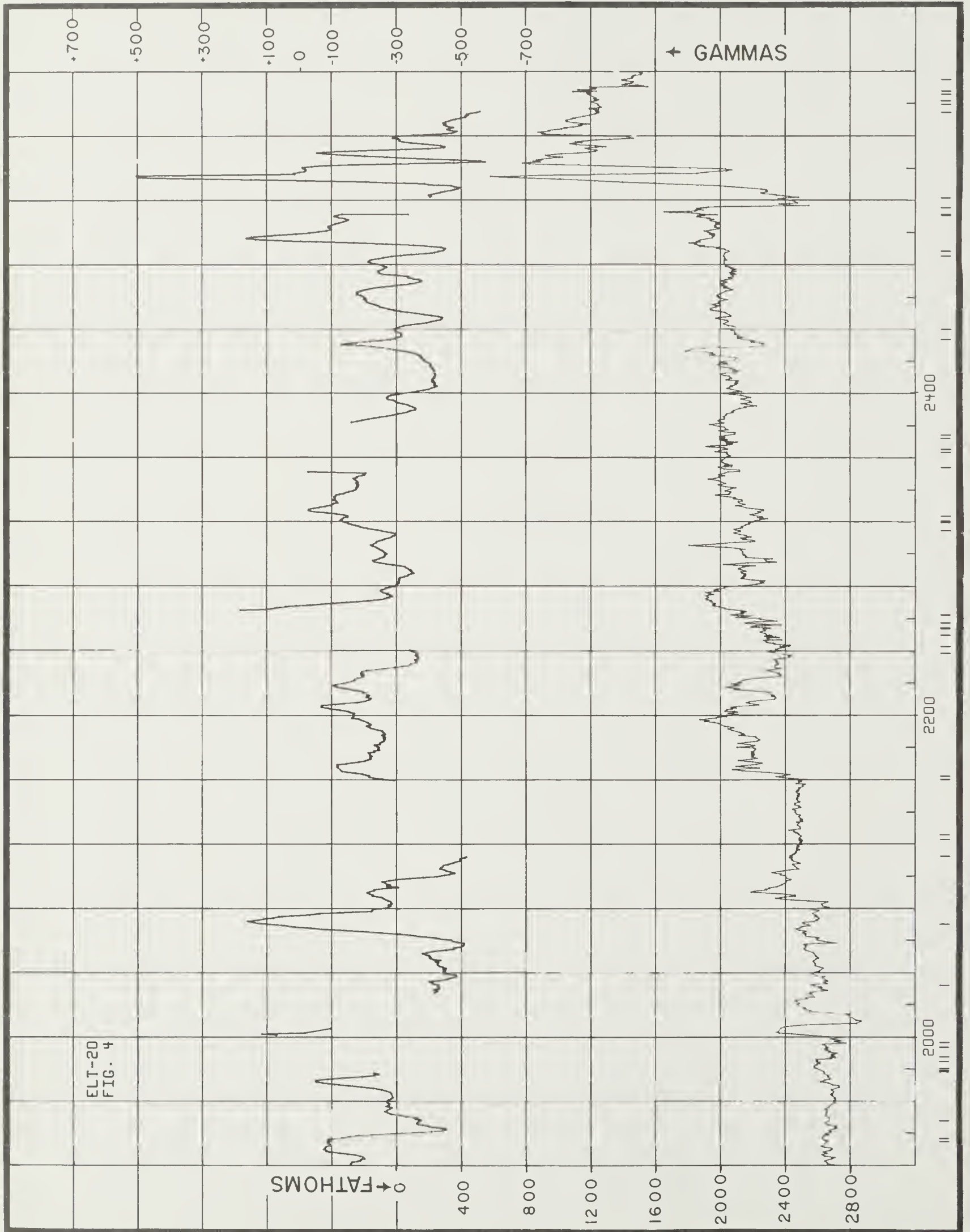


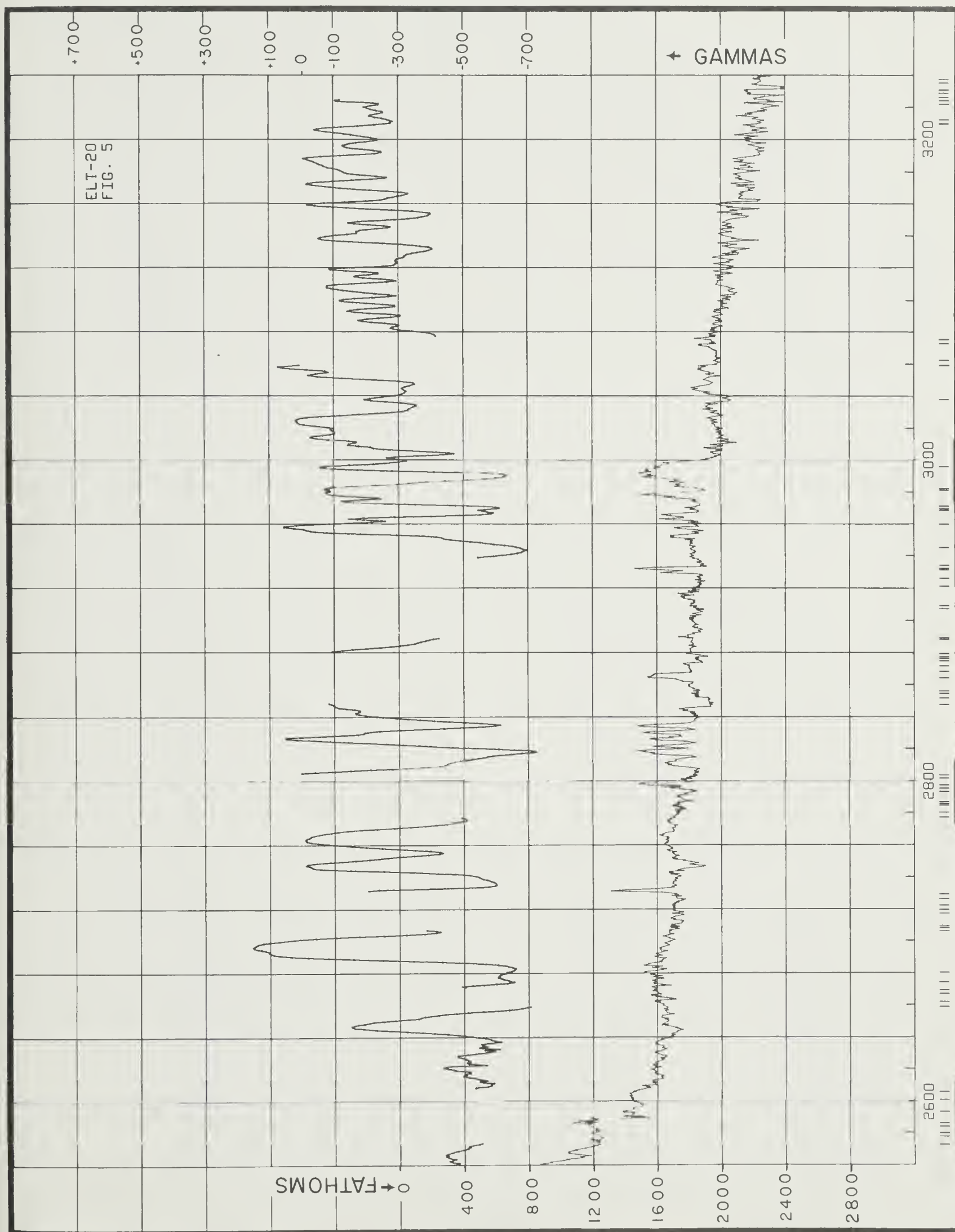


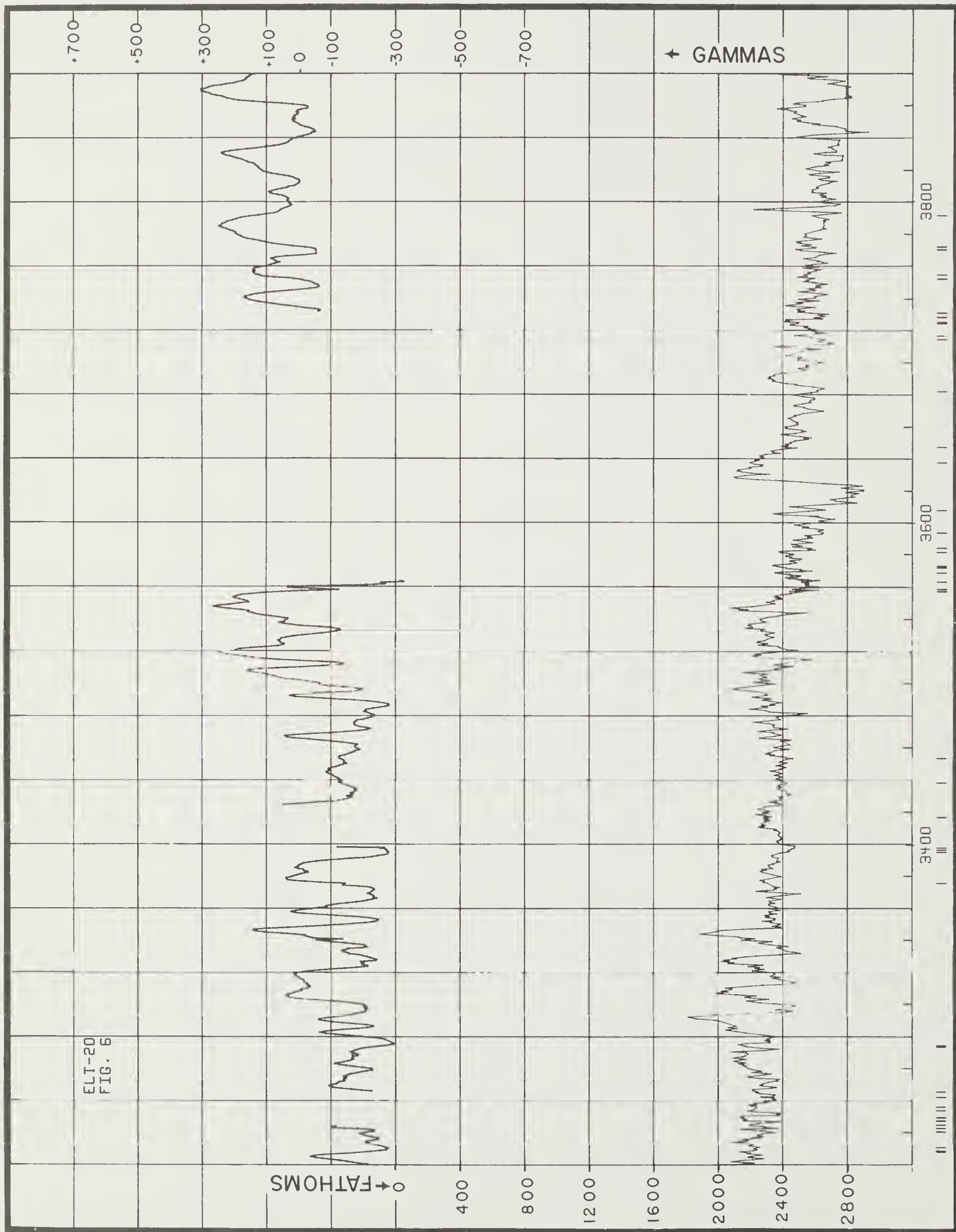


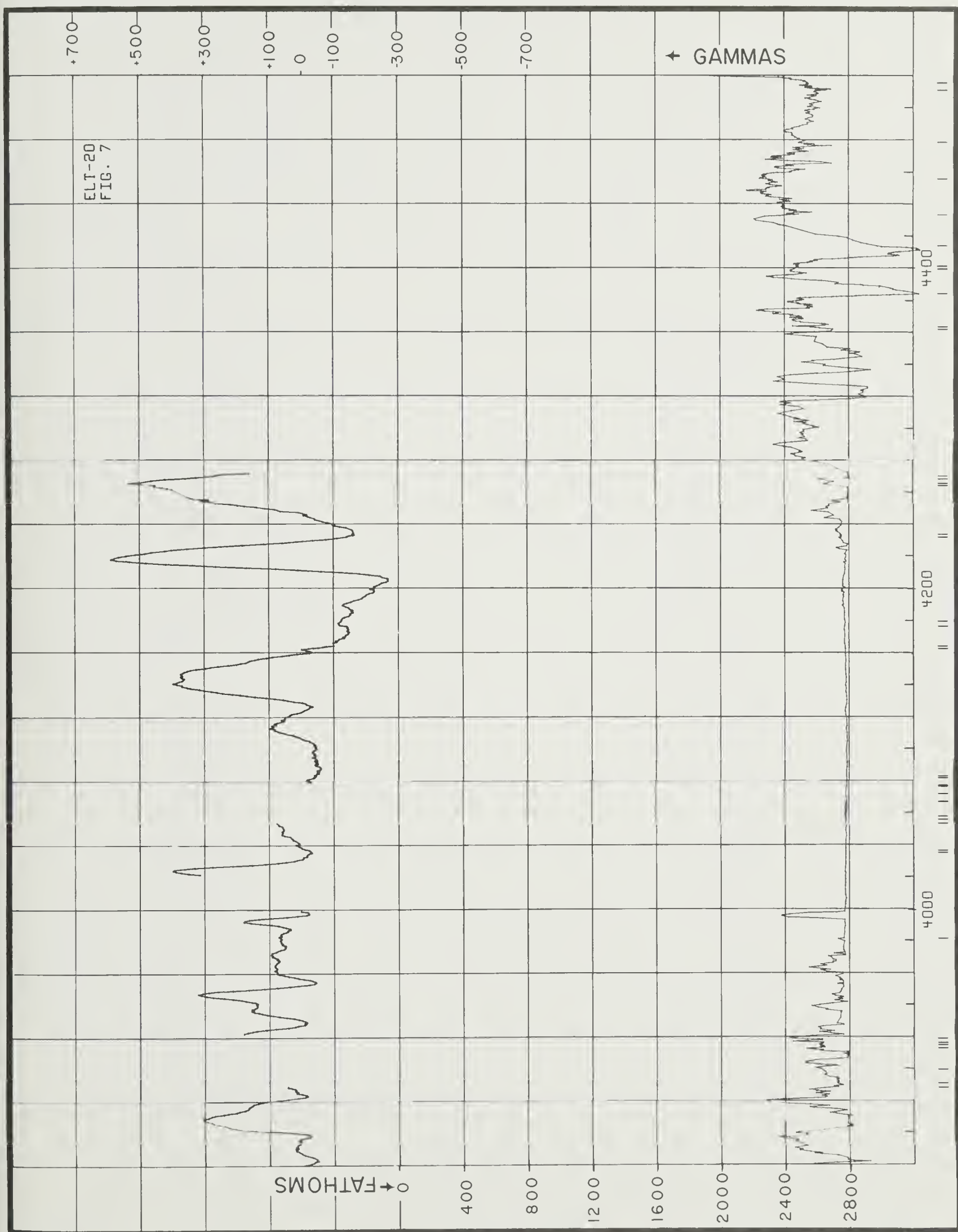


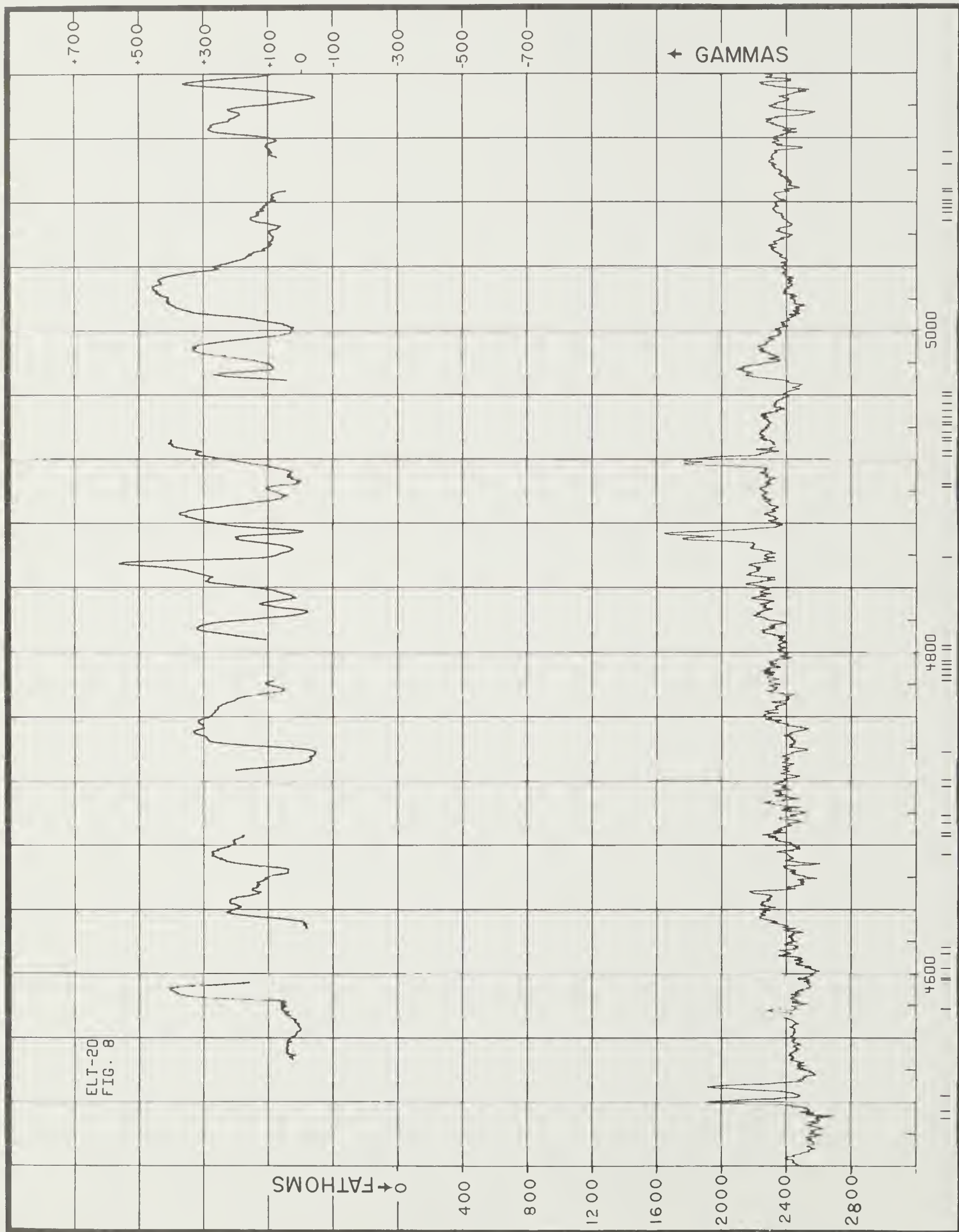


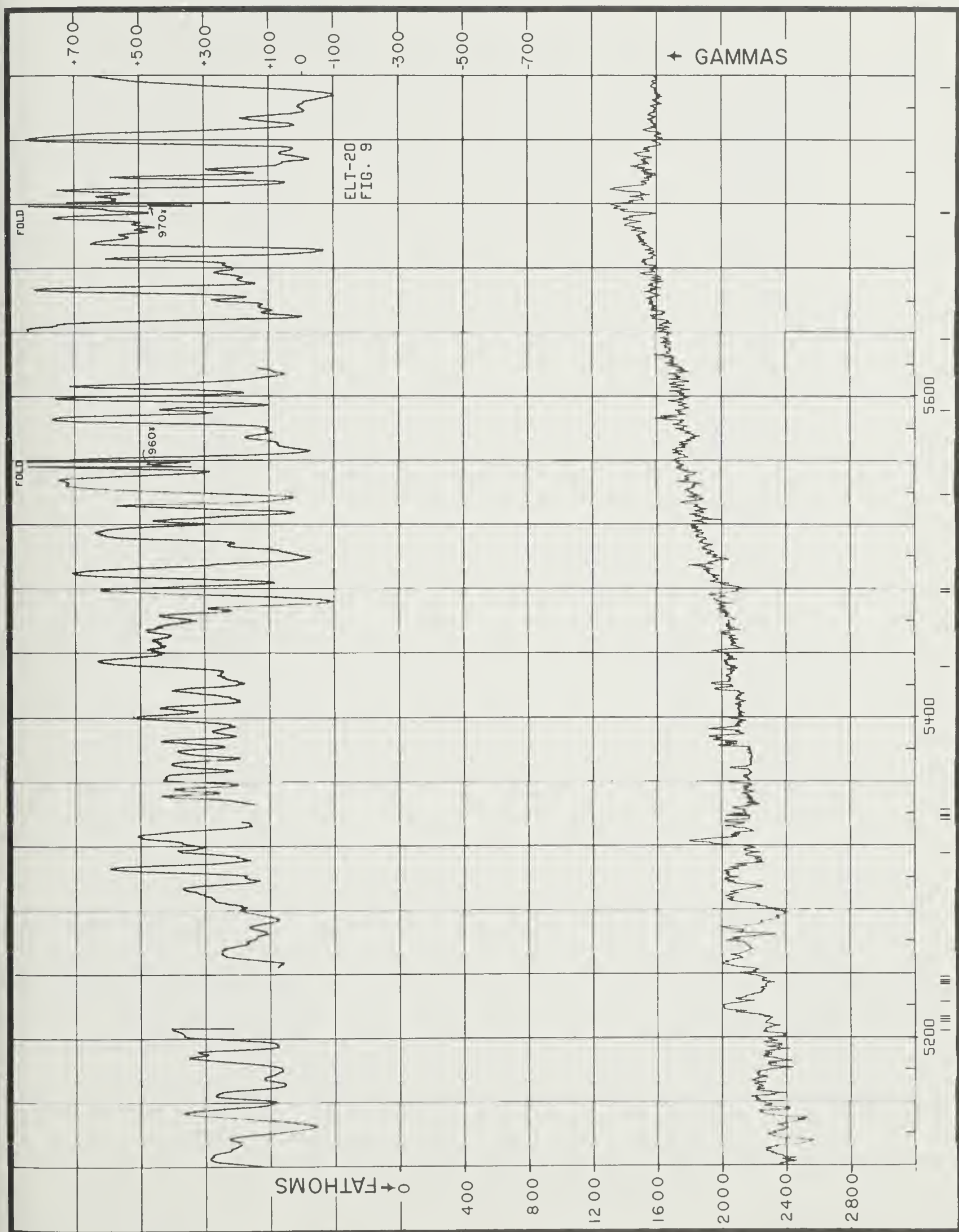


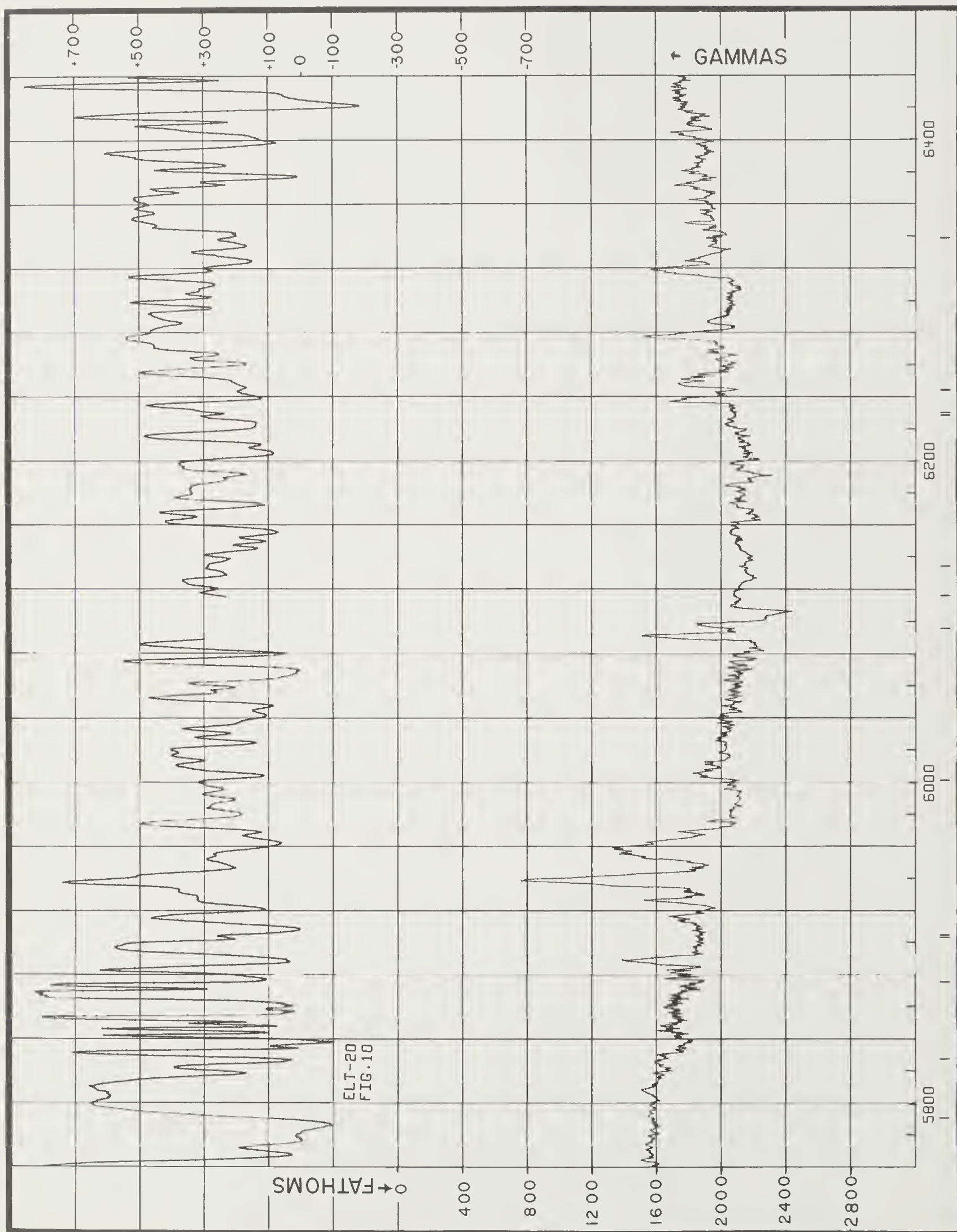


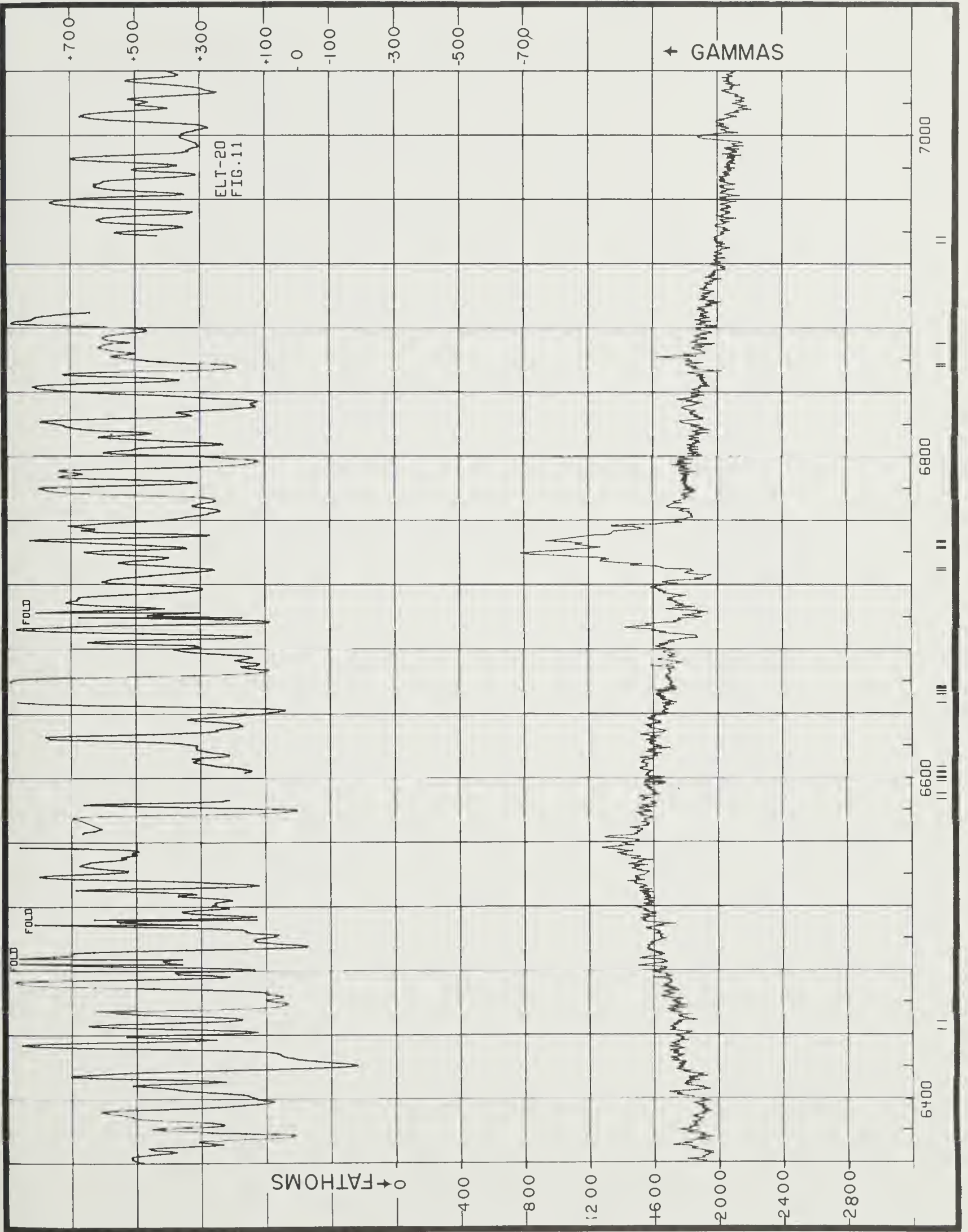


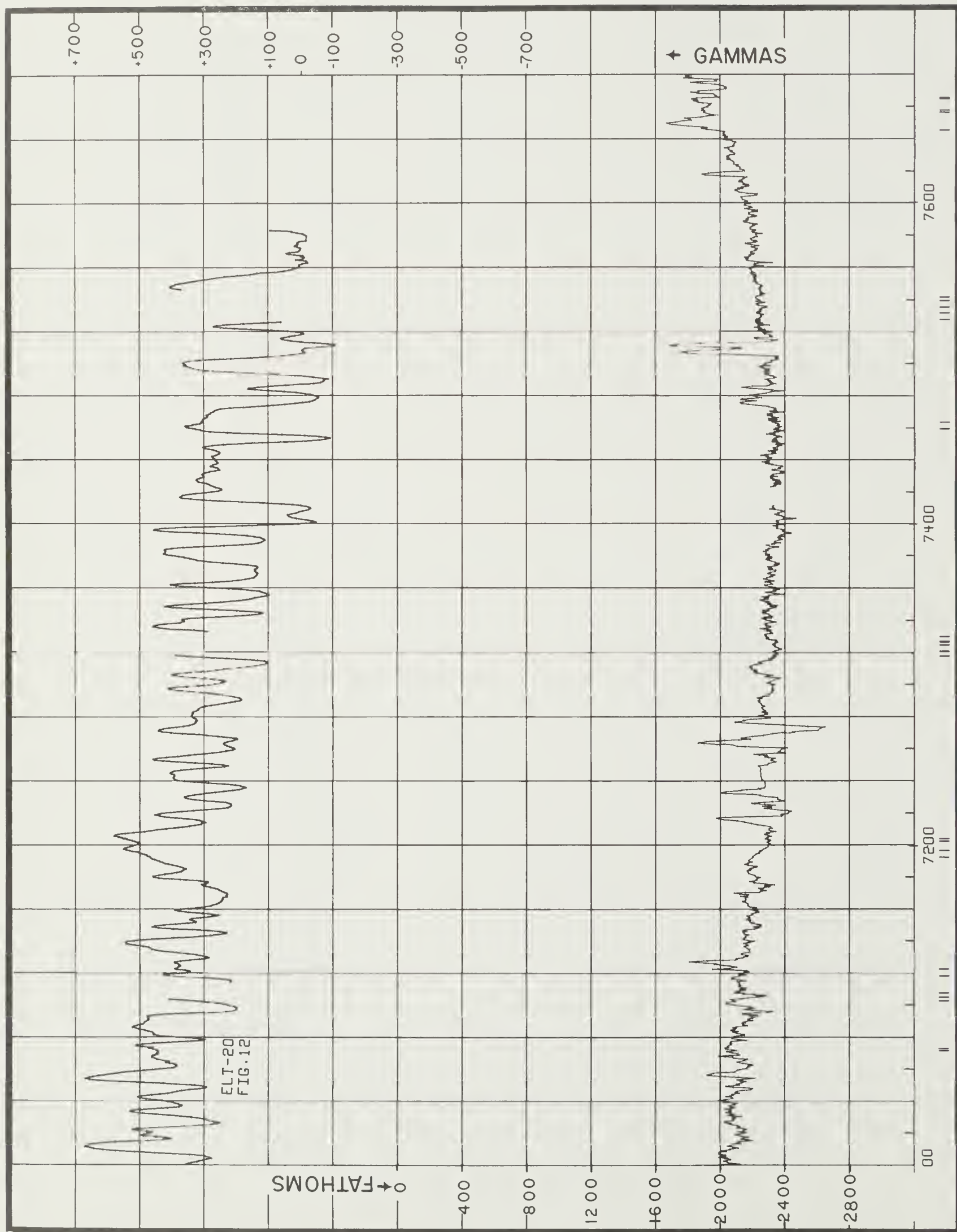


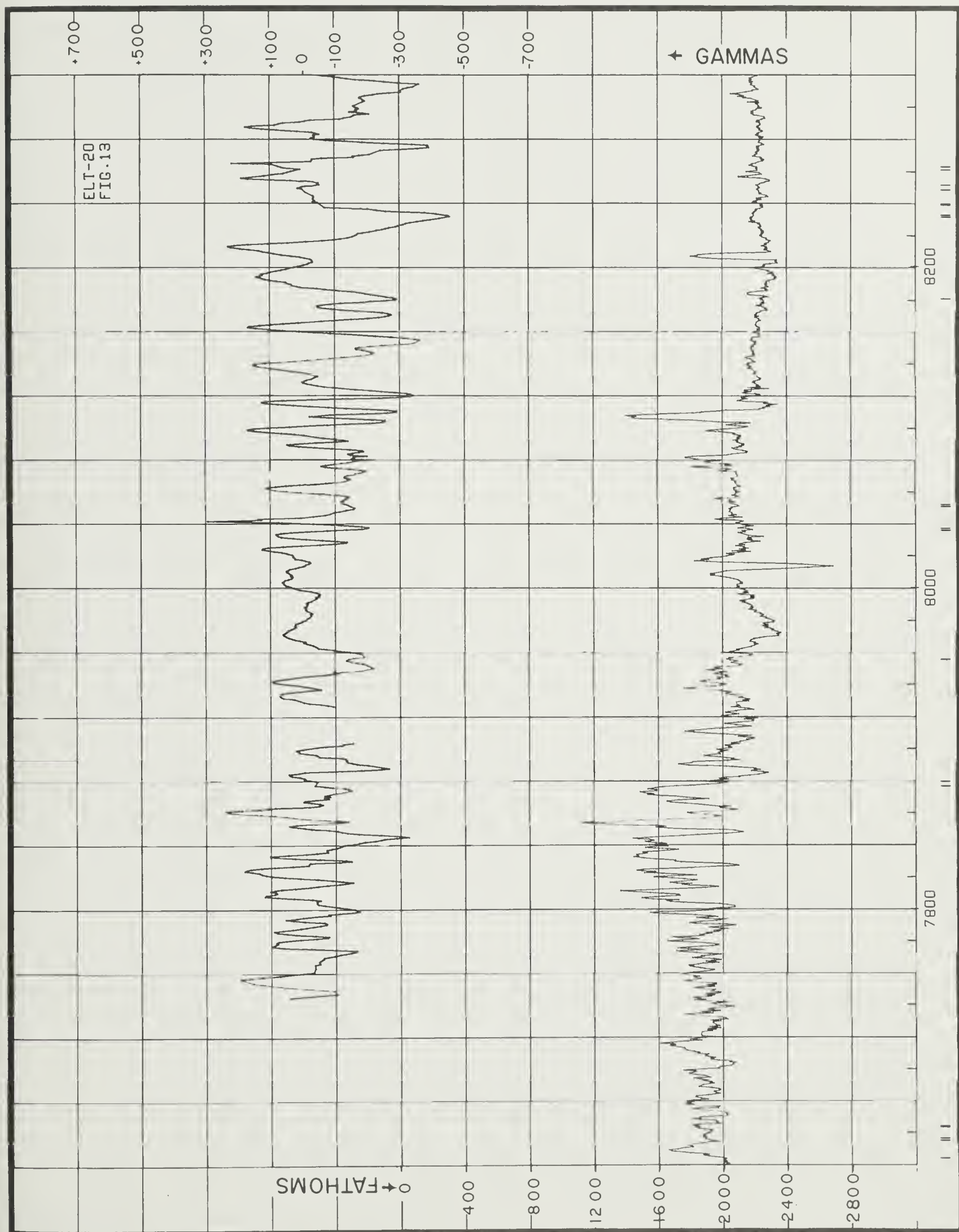


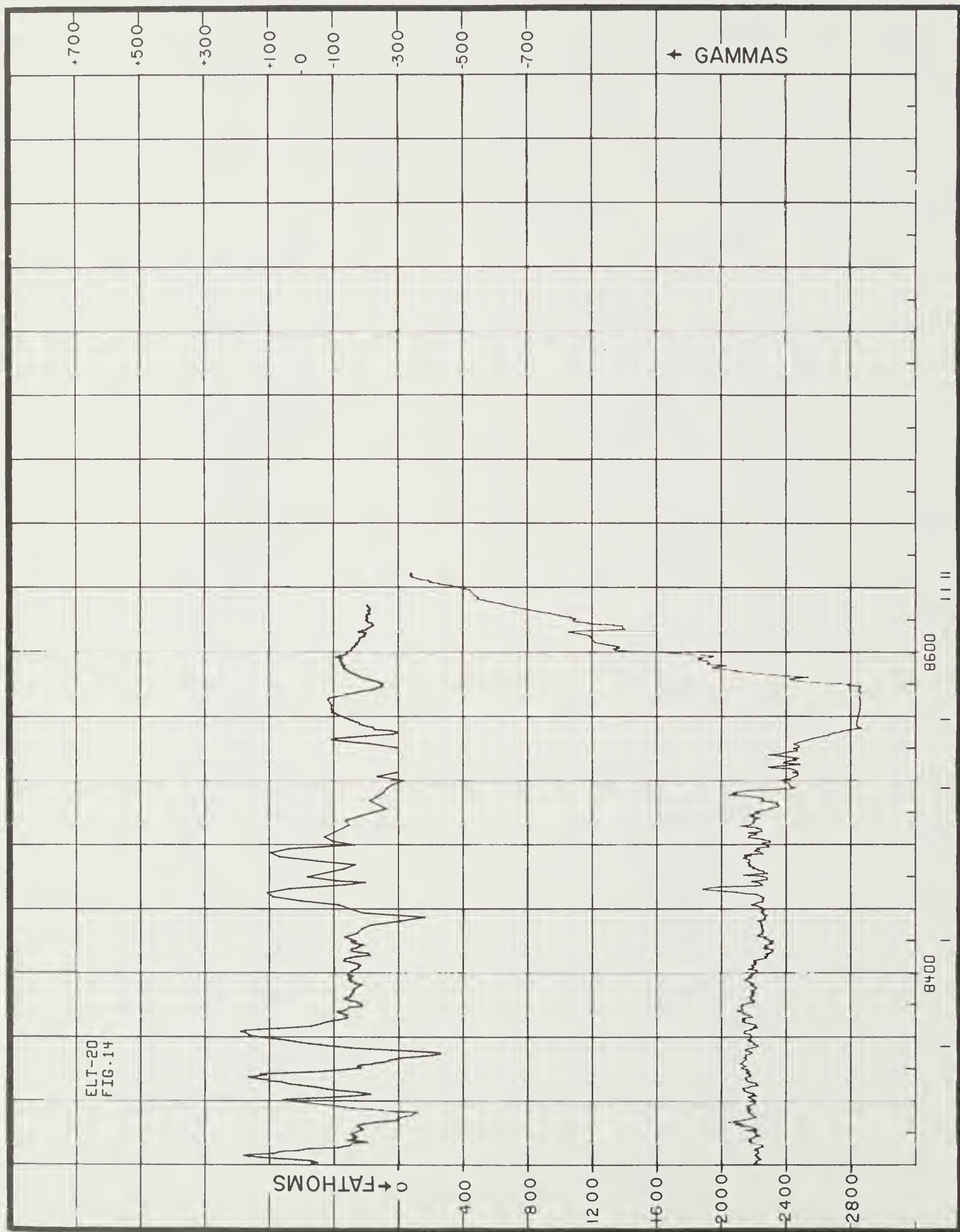


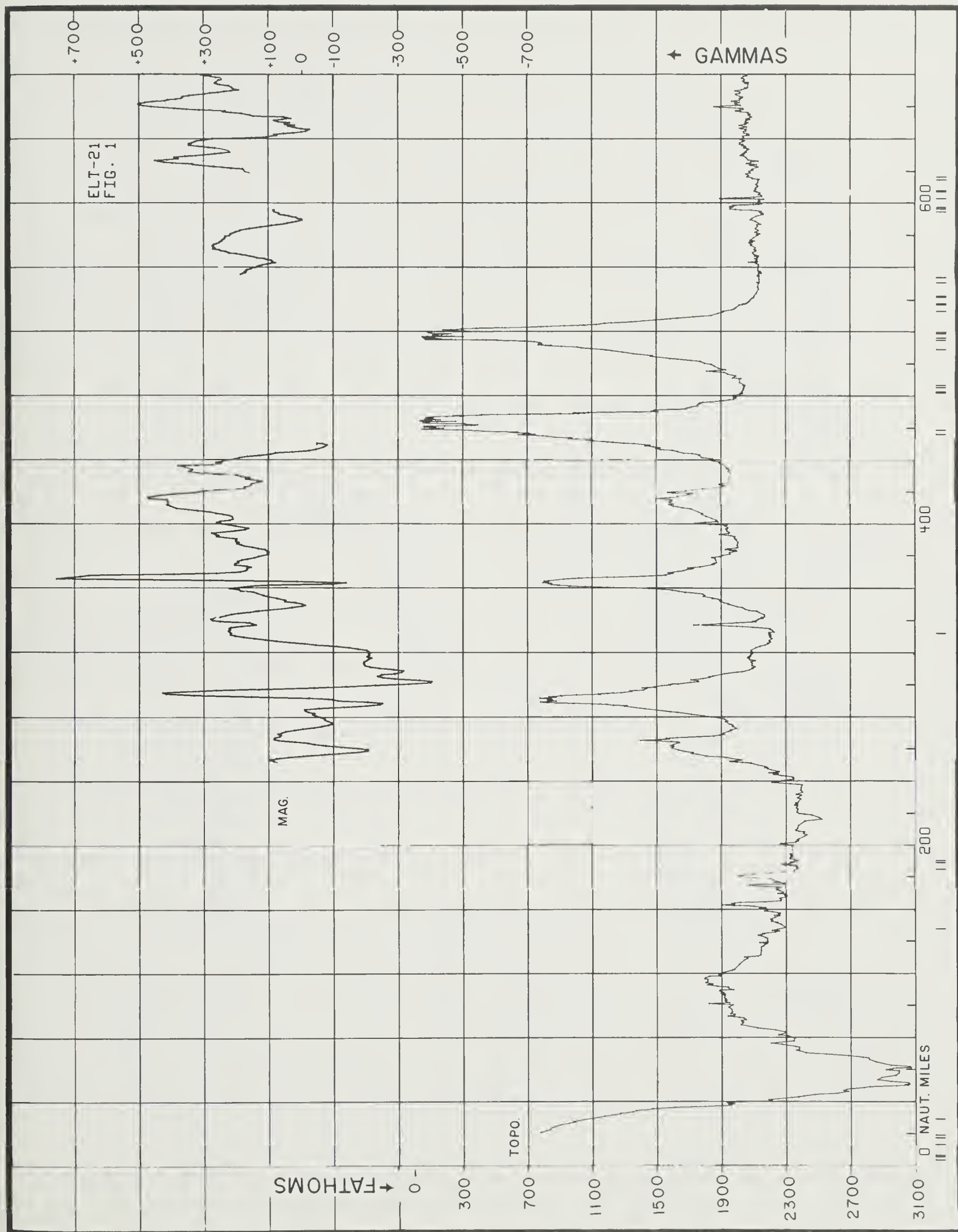


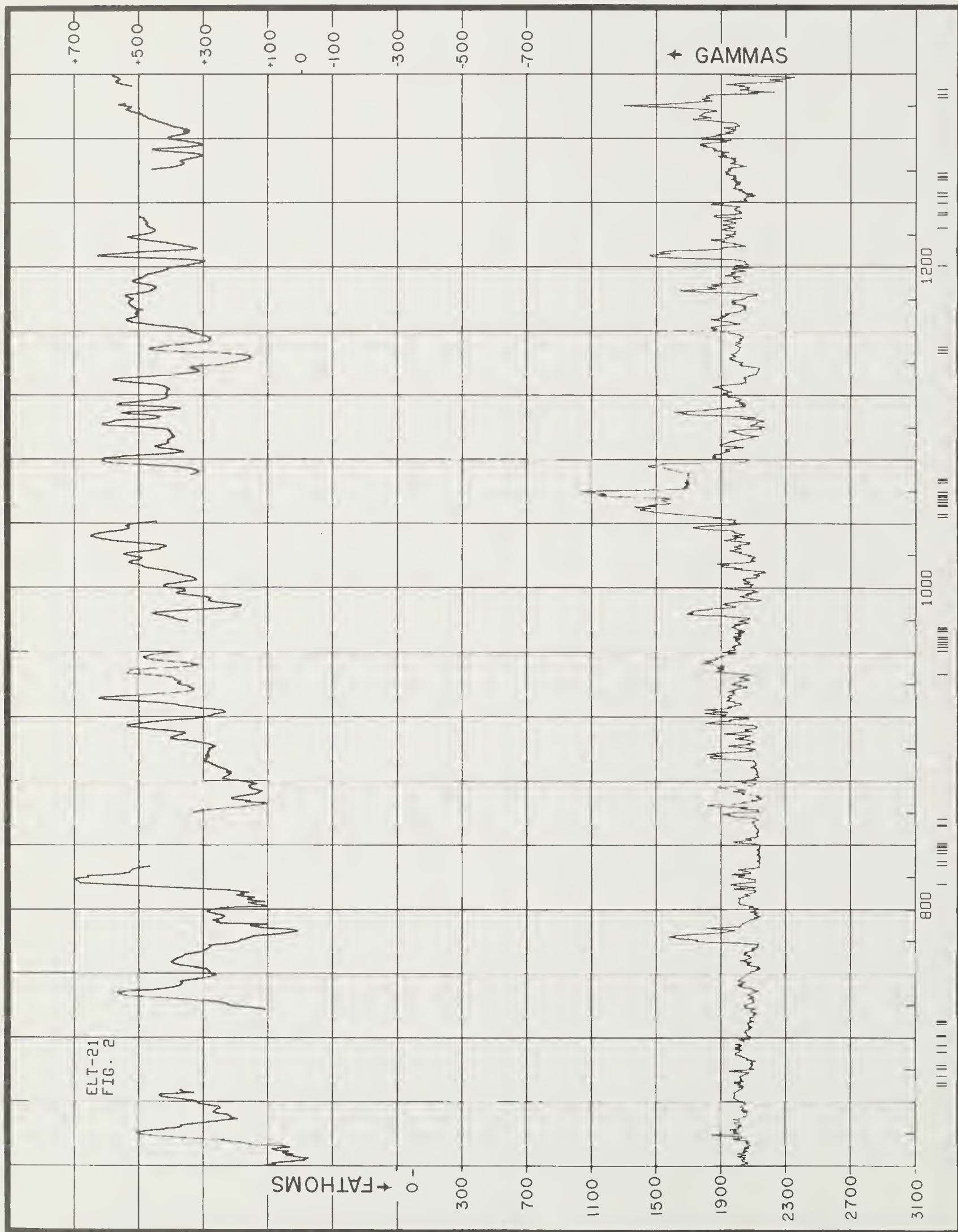


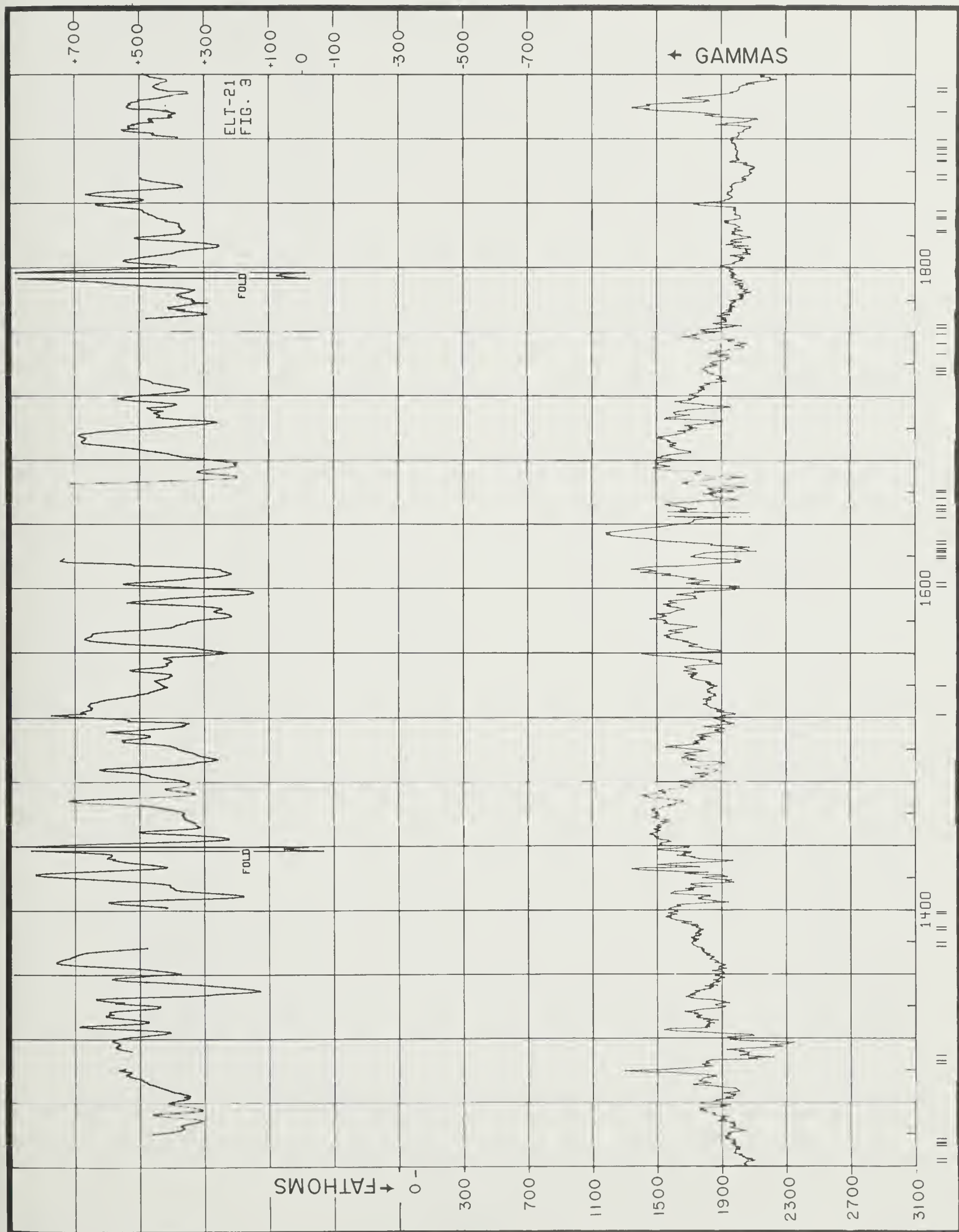


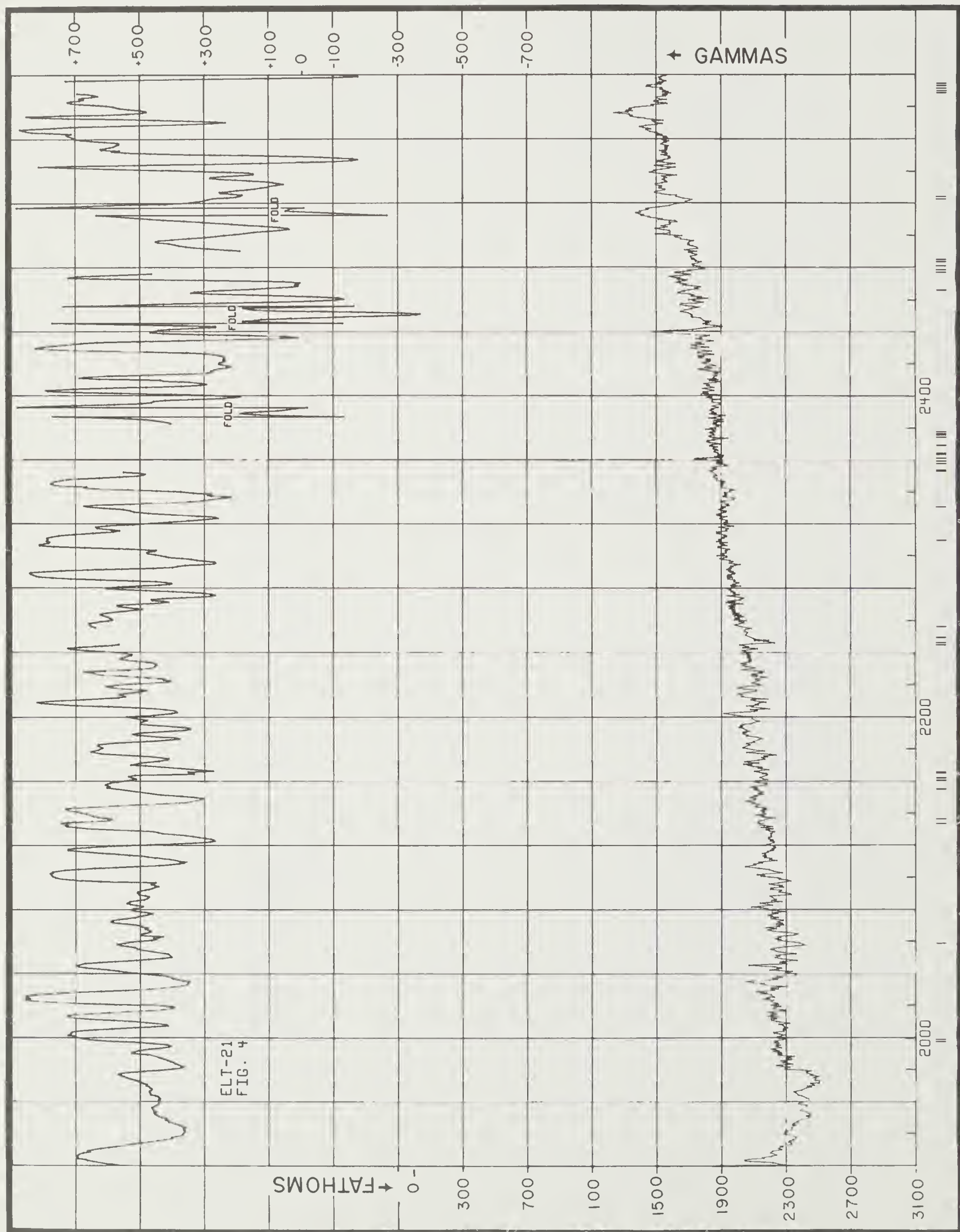


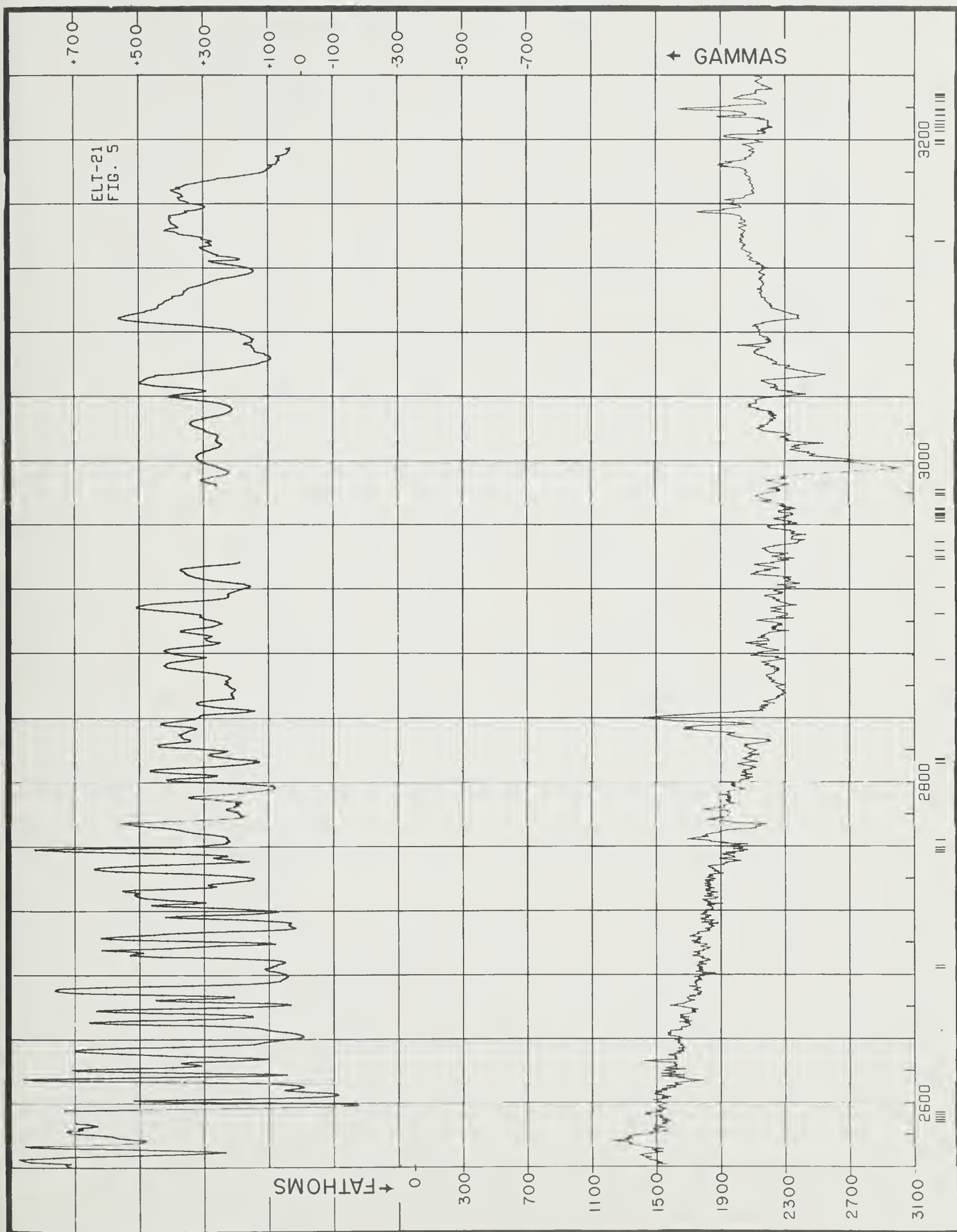


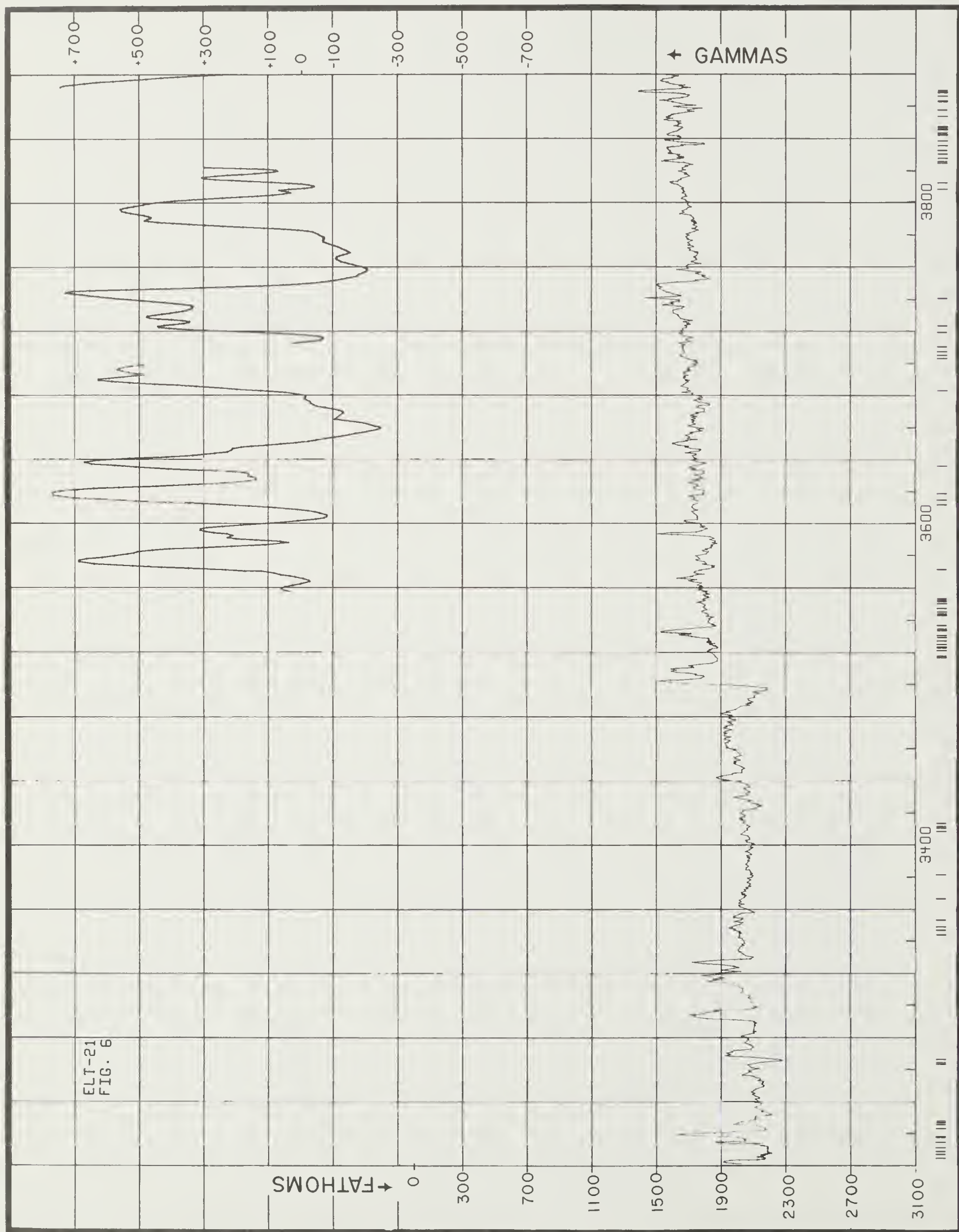


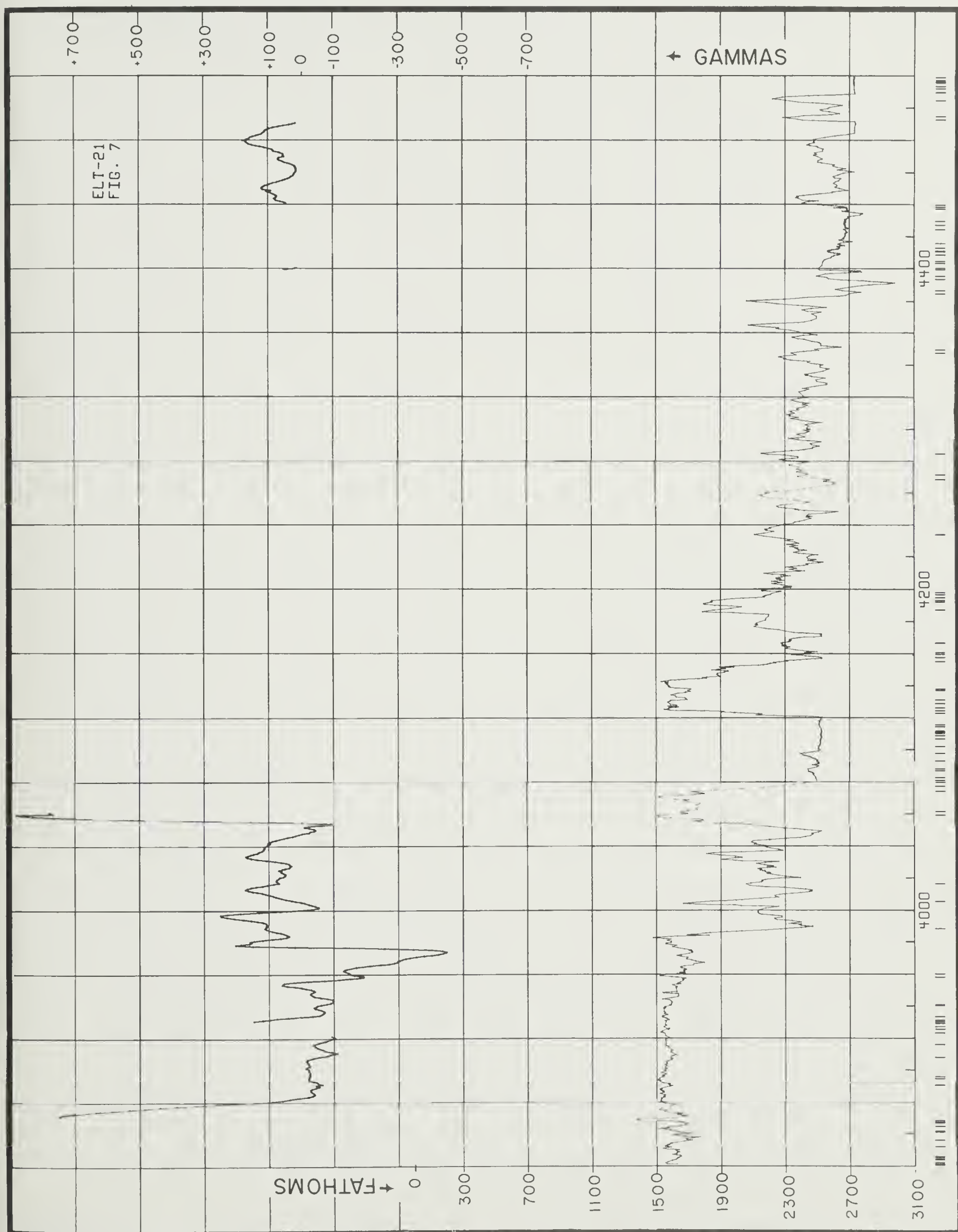


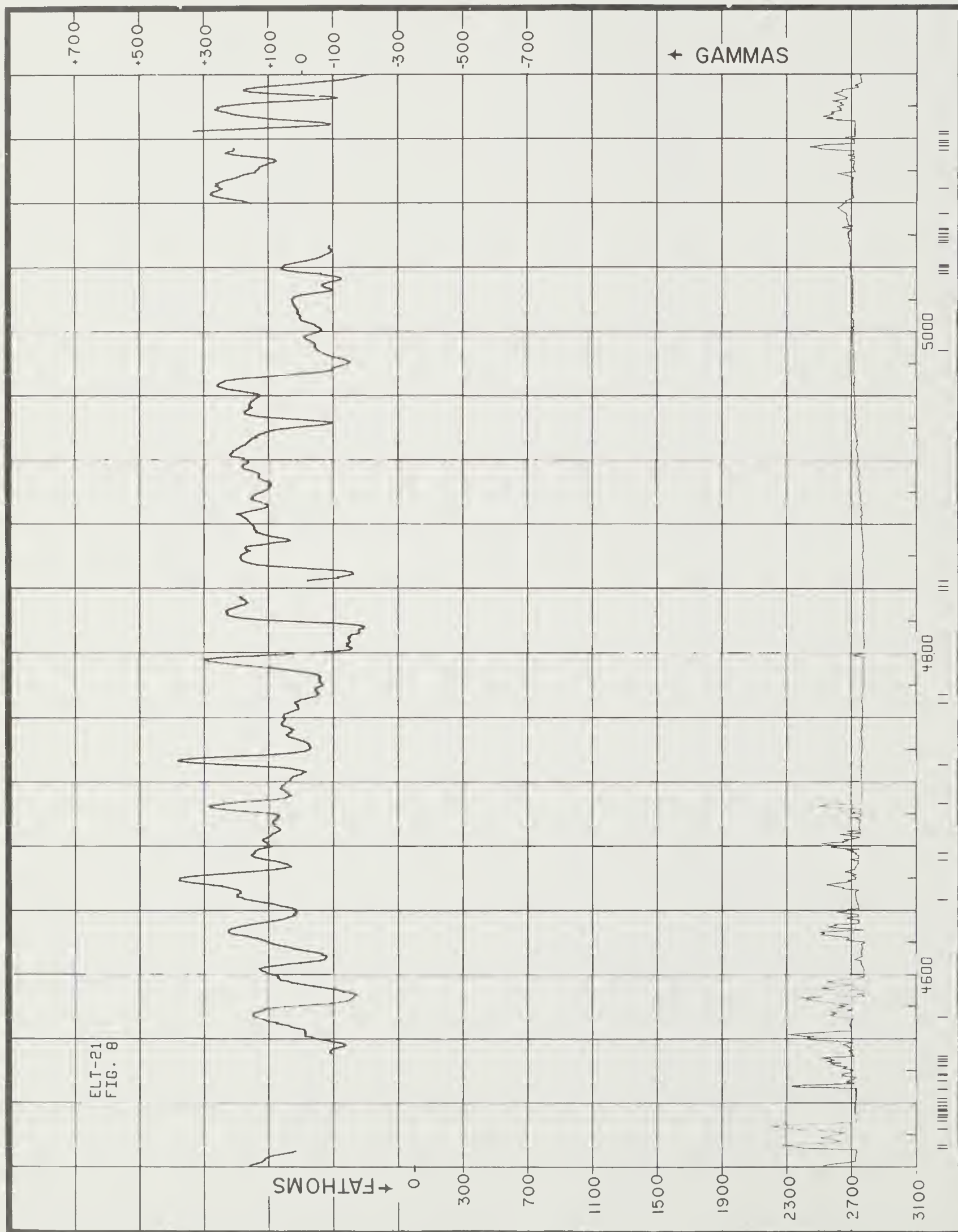


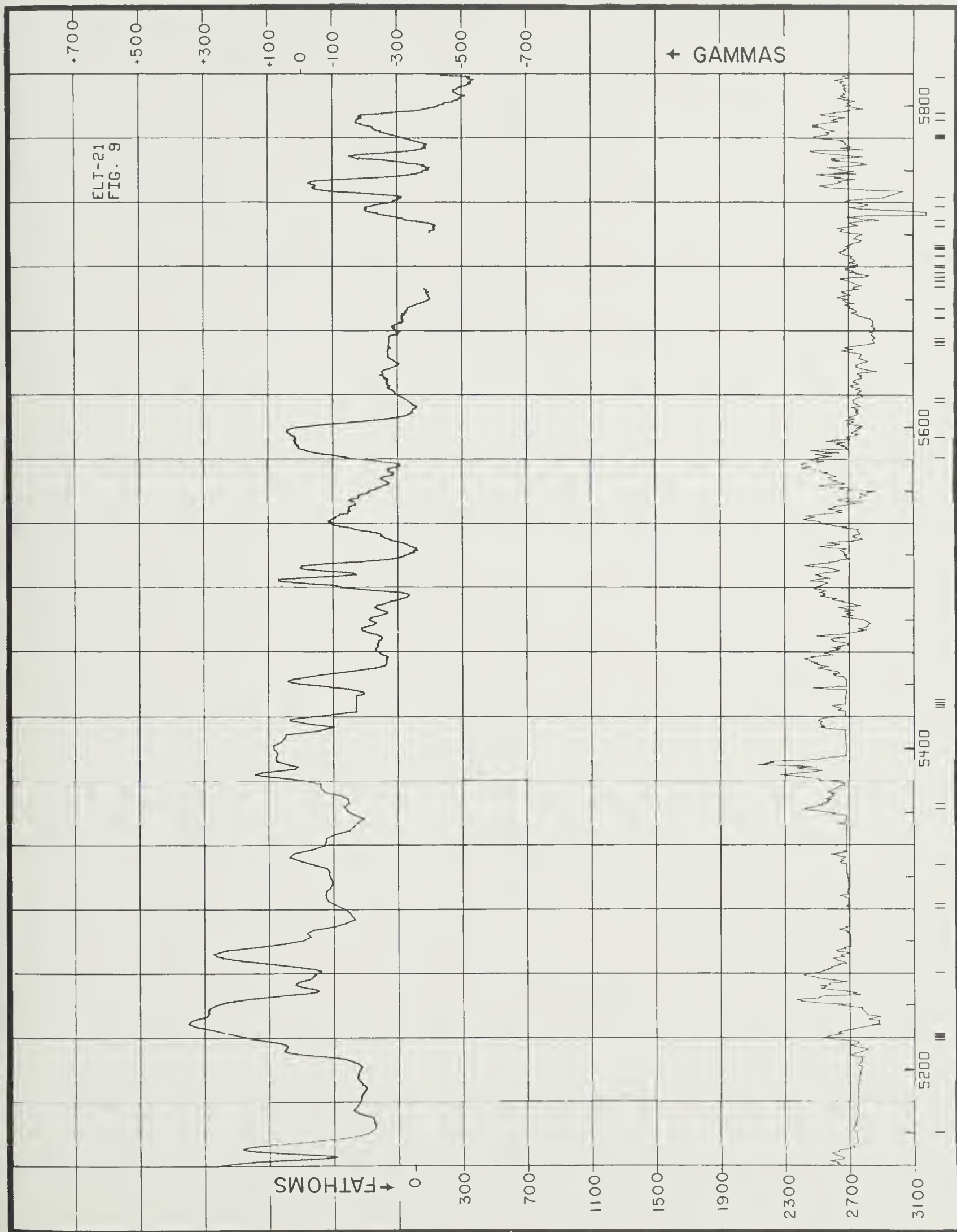


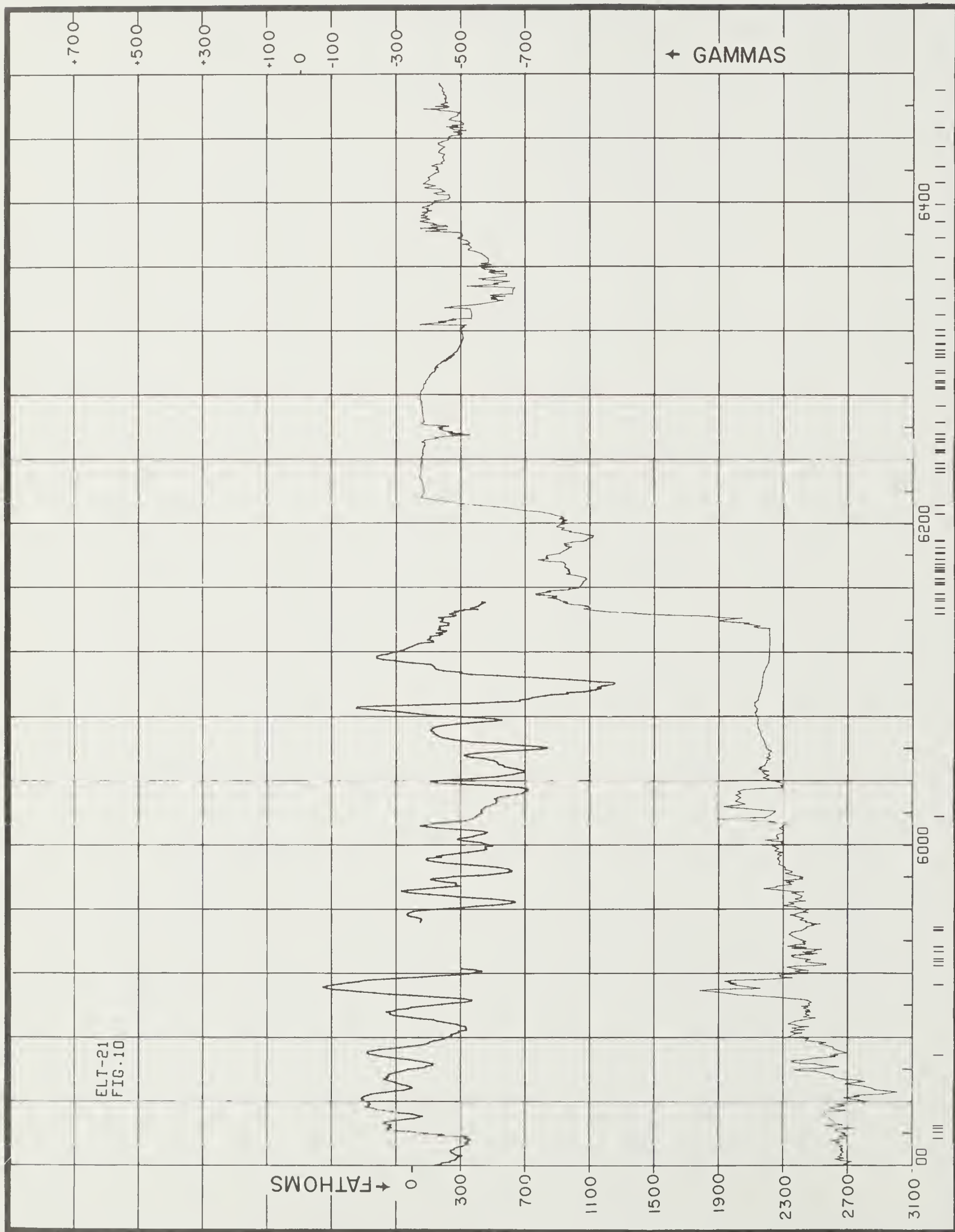




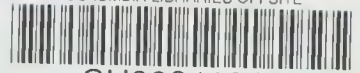








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**A PREDICTION OF SONIC PROPERTIES OF
DEEP-SEA CORES,
HATTERAS ABYSSAL PLAIN AND ENVIRONS**

by

D. R. Horn, Maurice Ewing, B. M. Horn and M. N. Delach

Technical Report No. 1

CU-1-69 NAVSHIPS N00024-69-C-1184

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INTRODUCTION

The ocean floor is divided into large physiographic provinces each of which is covered by deposits with a common set of characteristics. An understanding of the inter-relationships between physiography and sediment type is fundamental to effective use of the ocean floor as an acoustic interface. A prime objective of the Marine Geophysical Survey Project of the U.S. Naval Oceanographic Office was to define the effects of physiography and sediment on sound reflection, refraction, and absorption at or near the water-sediment interface. The problem is receiving considerable attention today (Egs. Heezen et al., 1967; Hamilton, 1969a; 1969b; 1969c; Hamilton et al., 1969; and Horn et al., 1968a, 1968b).

A survey of bottom topography and acoustic properties of the floor of the Hatteras Abyssal Plain was conducted as part of the Marine Geophysical Project (Atlantic Area 2, Alpine Geophysical Associates). Our study presents additional information on sediments of the same area. Lamont has collected 320 cores from the region which represents an increase in control on the distribution and properties of sediments of over 30 times that provided by coring activities of the MGS Project. With these data on hand it should be possible to test whether or not sonic properties of the ocean floor are strongly related to topography and/or sediment.

In Figure 1 are given MGS Atlantic Area 2 and the area described in this report. The latter is slightly larger in order to include all regions within and around the Hatteras Abyssal Plain which constitute distinct sedimentary environments. A complementary report on the Sohm Abyssal Plain is available (Horn et al., 1969b).

METHODS

Most cores at Lamont were taken by scientists and crews of research vessels VEMA and ROBERT D. CONRAD under the direction of Professor Maurice Ewing. All were examined and 101 selected as relevant to the purpose of the investigation. Of these, 66 have been matched to 75 acoustic stations of the Marine Geophysical Survey Project, some cores being related to more than one station. Matching of core data to MGS stations is shown on maps depicting submarine physiography and sediments of the area (Figs. 4 and 5); whereas specific data on each core are listed in the Appendices.

Diameter of the cores is 2 1/2 inches, and they range in length from 3 to 54 feet (average 23 feet). A complete description of the coring procedure and storage methods at the Observatory has been given by Ericson et al., 1961.

Mean grain size has been adopted as an index of the speed at which sound travels through unconsolidated deep-sea sediments

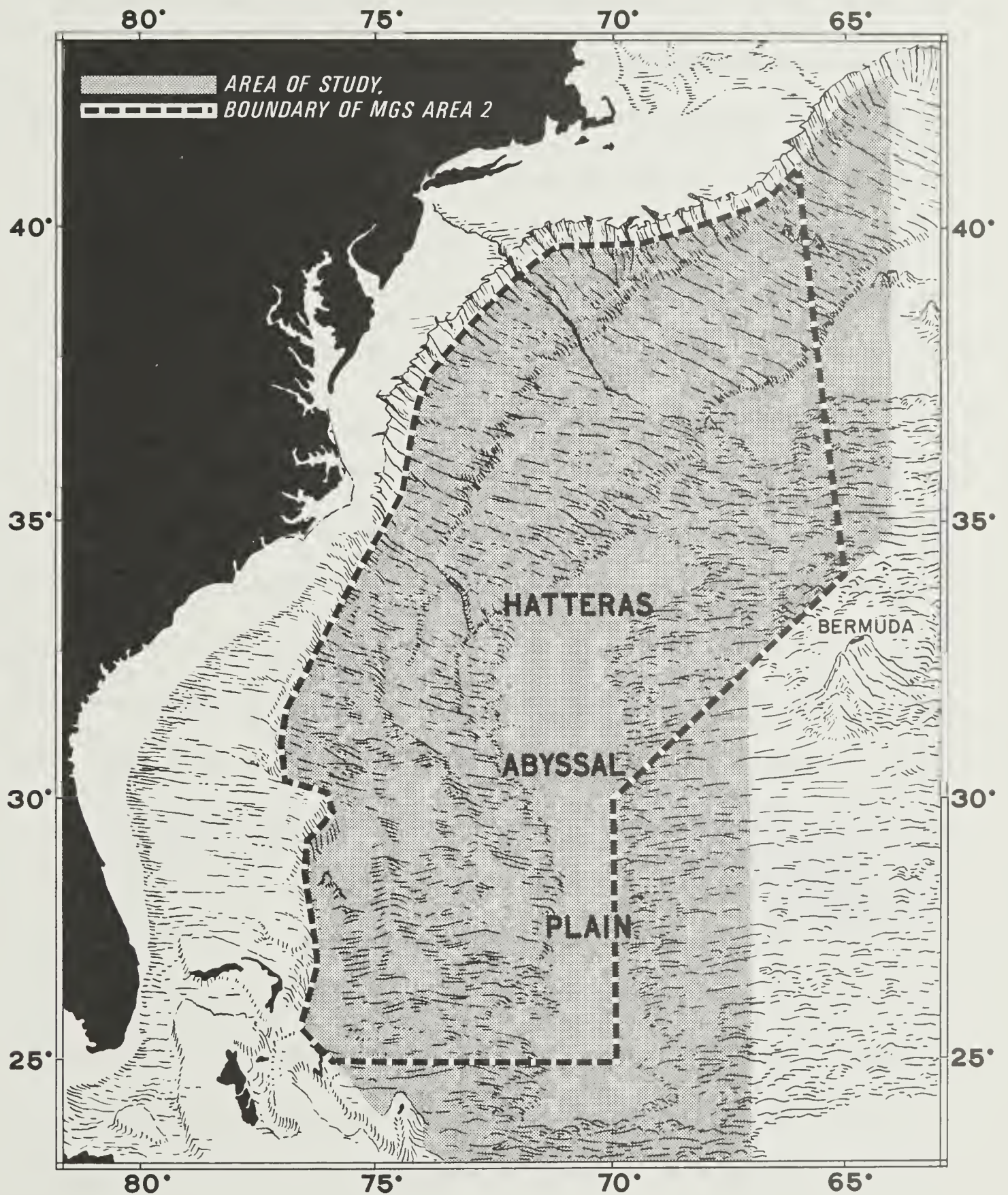


Figure 1. Index map showing locations of study area and MGS AREA 2, Northwest Atlantic. (Submarine physiography is from a portion of the Physiographic Diagram, Atlantic Ocean, published by The Geological Society of America. Copyright © 1957 by Bruce G. Heezen. Reproduced by permission.)

(hereafter referred to as sound velocity or velocity) because there is a strong correlation between particle size and sound velocity (Horn et al., 1968, 1968b). Cores were first described then sampled for textural analysis. Mechanical analysis followed the combined sieve-pipette technique outlined by Folk (1968). Gravel and sand fractions were sieved through calibrated nests of 8-inch sieves at 1/4 phi intervals. Mud and clay were analyzed by the pipette method with aliquotes taken at 1/2 phi intervals.

Under a separate program, sound velocities were determined through lined cores which were immediately split and sampled at the precise points where velocity measurements had been made. The results enable us to relate sound velocities to 562 determinations of mean size and 1093 of wet density. Plots of mean grain size versus velocity and wet density versus velocity are given in Figures 2 and 3. All laboratory measurements of velocity are adjusted to 23°C and a pressure of 1 atmosphere. Least squares curves to the third order were then fitted to these data by computer and predictions of the velocities made at specific intervals of mean size and wet density. Appendix C lists velocities related to a range of mean grain size from 0.50 to 500 microns and wet densities from 1.18 g/cc to 2.28 g/cc. If the results are to be compared with in situ measurements they must first be corrected to prevailing conditions of temperature and pressure (see Hamilton, 1963, 1969c).

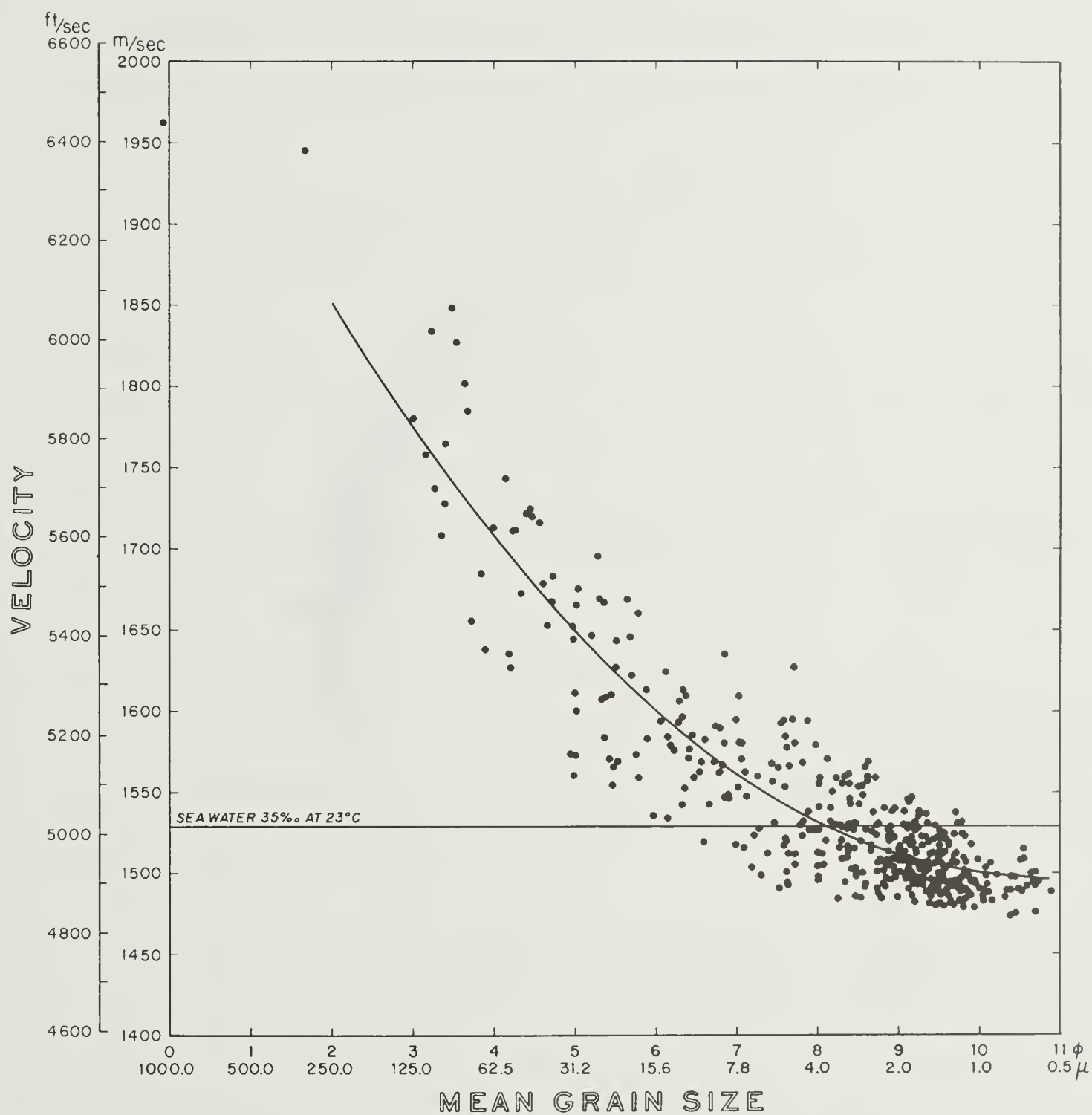


Figure 2. Mean grain size of unconsolidated deep-sea sediments plotted against sound velocity through sediment.

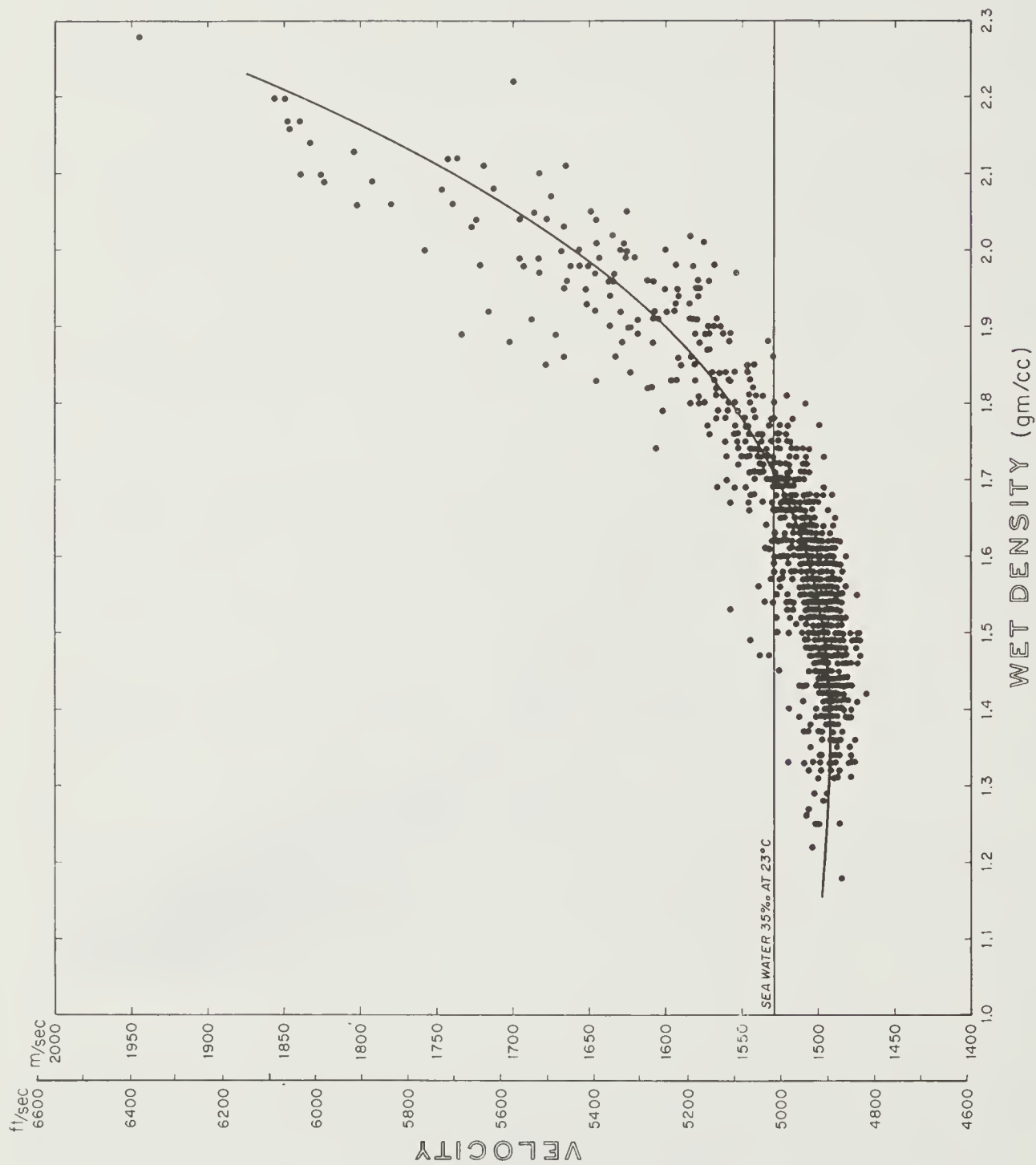


Figure 3. Wet density of unconsolidated deep-sea sediments plotted against sound velocity through sediment.

Predictions of wet densities and sound velocities of cores from the Hatteras Abyssal Plain are given in Appendix D. They were determined using the listing presented in Appendix C. The method employed in predicting wet densities and velocities is to determine the mean size of a given layer by conducting a textural analysis of a representative sample from the layer. The resulting average size is then entered into the listing given in Appendix C and corresponding densities and velocities are taken from the table. These values in conjunction with others are used to draw the velocity and wet density profiles of the cores in Appendix D. Tests of the predictions against laboratory measurements are in progress and initial successes afford confidence in the procedure.

The format of the report is constructed such that the reader can locate either an MGS station or core within his area of study by referring to Figures 4 and 5. After selecting a station or core, Appendix D can be used to obtain details of sediment lithology along with predictions of wet density and sound velocity.

ACOUSTIC DOMAINS OF THE OCEAN FLOOR

In recent years attention has been directed toward understanding properties of the ocean floor which bear on the use of low frequency profiling equipment and sonic devices employing the bottom as an acoustic interface. Initially most investigations of sonic properties of sediments were confined to laboratory measurement of sound velocity through cores of marine deposits (e. g., Hamilton et al., 1956;

Sutton et al., 1957; Nafe and Drake, 1957, 1961, 1963; Shumway, 1958, 1960a, 1960b; Schreiber, 1968; Horn et al., 1968a; and many others). Under the leadership of Hamilton, critical information is being gathered by divers and submersibles which links experimental and in situ results (Hamilton et al., 1956, 1969; Hamilton, 1963). The entire subject of acoustic and related properties of marine sediments is thoroughly described in a series of excellent reports by Hamilton (1969a, 1969b, 1969c). The main conclusion drawn from the investigations is that a strong correlation exists between acoustic and other physical properties of unconsolidated marine sediments.

The success of relating sound velocity to certain properties of sediments has led to considerable expansion of efforts which combine marine geology and acoustics of the sea floor. Current research is directed toward defining major regions of the world's oceans which possess similar sonic properties (Heezen et al., 1967). Heezen and his associates pointed out that acoustic domains coincide with major physiographic provinces of the world's oceans.

At the same time, Hamilton (personal communication) advocated that in order to understand the acoustic character of the sea floor, it was necessary to have knowledge of submarine physiography along with sedimentary environments and processes. He discusses the thesis in detail in his recent reports (Hamilton, 1969a and 1969c).

Such reasoning led to compilation of physiographic maps and definition of sedimentary provinces of the North Pacific by Horn et al. (1968b, 1969a, 1970a, 1970b).

The concept very briefly stated is that physiography plus sediment determine the acoustic nature of the ocean floor. A final test of the thesis remains to be made. The northwest Atlantic possibly offers the most complete set of data for such work. This report provides details of sediment types and their distribution within and around the Hatteras Abyssal Plain. In addition, the position, thickness and character of reflective horizons are given. Predictions of parameters used to calculate acoustic impedance of layers comprising cores are listed in Appendix D. Acoustic measurements and descriptions of physiography are contained in the reports of the Marine Geophysical Survey Project (e. g., Schreiber, 1967) and on physiographic diagrams compiled by Heezen and Tharp (1957 and 1968). If the underlying premise is correct, there should be a strong correlation between reflectivity, physiography and sediment type.

DISTRIBUTION OF LAYERS CONSIDERED POTENTIAL REFLECTORS OF SOUND, HATTERAS ABYSSAL PLAIN AND ENVIRONS

General statement

Sound reflection at or just below the water-sediment interface is a function of many variables, not the least of which are roughness

(geometry, shape) and distribution of sediment layers which represent abrupt impedance contrasts within the sediment section. The relation of roughness to acoustic properties of the sea floor is the subject of research being conducted by Dr. G.M. Bryan at Lamont-Doherty Geological Observatory. Only major submarine physiographic elements of the Hatteras Abyssal Plain and contiguous areas are presented here (Figs. 4 and 5). In the region of the Hatteras Abyssal Plain, distribution of reflecting horizons is directly related to coarse layers deposited by turbidity currents.

Well-defined sand and silt units of intermediate to high sound velocity and wet density (sharp contrasts of acoustic impedance) have been divided into four qualitative classes. They are considered potential reflectors of sound and include: 1) Good reflector -- >10 cm thick, 2) Intermediate reflector -- 5 to 10 cm thick, 3) Poor reflector -- <5 cm thick with clear-cut upper and lower limits, and 4) Questionable -- <5 cm thick with poorly defined limits. Position and thickness of these layers are shown graphically in Appendix D.

Distribution, thickness and position in the sediment section of good and intermediate reflectors (classes 1 and 2) are given in Figure 4. Thinner layers (classes 3 and 4) are not included in Figure 4 for the following reasons: 1) they may be acoustically transparent, and 2) they tend to blur boundaries between areas of good reflectors and regions where there are none. Should a need

arise for information on the distribution of lower ranks of potential reflectors they occur along the western margin of the Hatteras Abyssal Plain within two regions identified as predominantly clay with occasional silt layers (Fig. 5). Their position and thickness are also indicated in Appendix D. If major textural divisions of the sediments (i. e., sand, silt, mud, clay) are required, they are given in Figure 5.

Considerable care and effort have gone into preparation of Figures 4 and 5 to eliminate the need of lengthy discussion and to facilitate rapid visual communication of the location and nature of potential reflectors. Comparison of the figures reveals good and intermediate reflectors coincide with areas where the normal clay section is abruptly interrupted by graded, coarse deposits. The latter provide sharp impedance contrasts close to the surface of the sediment sequence. The abyssal plain has both the geometry and sediment necessary for good reflection of sound.

Reflectivity within the limits of Hatteras Abyssal Plain

The northern portion of the plain is characterized by sand and silt intercalated with clay. Coarse units act as good reflectors and strong reflection of sound should take place. It is speculated that the highest values of reflectivity encountered in the Hatteras Plain will occur in regions where sand layers constitute a significant portion of the sediment section. The northern part of the Hatteras

Abyssal Plain is the site of sand accumulation and presumably will reflect sound better than the remainder of the plain.

Central and southern regions lie beyond sand emplacement. Sediments are silt interstratified with clay. Here silt layers serve as multiple sub-bottom reflectors. Their finer grain size and thinner layering offer less impedance contrast with intercalated clays. Overall reflectivity of the sea floor will be lower. A slight thickening of silts at the southern end of Hatteras Plain suggests ponding of turbidity currents behind its southern topographic limit. Thickening of the layers may result in slightly better reflection of sound at the southern end of the plain.

Acoustic properties of sediments from areas surrounding Hatteras Abyssal Plain

To the east, south and southwest of the plain, uniform brown and gray clay cover the ocean floor (Fig. 5). Potential reflecting horizons are extremely rare (Fig. 4). The change from interstratified coarse- and fine-grained deposits of the plain to monotonous clay sequences of abyssal hills is abrupt. The boundary coincides very well with limits of the Hatteras Abyssal Plain presented on physiographic diagrams (Heezen and Tharp, 1957 and 1968). A combination of increase in bottom roughness with low velocity sediments in regions of abyssal hills suggests areas surrounding the abyssal plain will be characterized by poor reflectivity.

The situation is slightly different along the northwestern

limit of the plain. Here widely spaced and very thin layers (predominantly 1 cm thick) of silt and sand are interlayered with thick units of clay. They are either products of settling of finest fractions of turbidity currents or may be coarse materials deposited by geostrophic currents (e. g., Hubert, 1964; Heezen and Hollister, 1964; Heezen et al., 1967). Distribution of the layers is limited to the outer continental rise. These thin but relatively coarse layers may be acoustically transparent when taken individually. Nonetheless, they occur throughout the length of the cores and when combined may have an additive effect which produces an over-all value of intermediate reflectivity at the outer limits of this physiographic province.

The inner continental rise and continental slope are covered by thick sections of hemipelagic muds and clays (Fig. 5). There is a slight and progressive increase in mean grain size toward land. Lack of discrete layering, rapid variation in mean grain size over short distances, and progressive increase in bottom slope and roughness presumably cancel out improvement in reflectivity normally associated with increase in mean grain size. Prediction of bottom reflectivity in this region is hazardous. Hamilton (1969c) indicates a need for detailed sediment charts of the continental shelf before making predictions of its acoustic properties. Heezen et al. (1967) report considerable variation in the reflectivity of the

continental slope and continental rise. Our examination of cores from these physiographic provinces corroborates their findings. Sediments are extremely variable and are laid down on a highly irregular surface. Shape of the ocean floor and nature of the sediments combine to give a bleak picture of predicting the regional acoustic character of either the inner continental rise or continental slope.

Blake-Bahama Abyssal Plain

The narrow Blake-Bahama Abyssal Plain lies immediately seaward of the Bahama Islands (Fig. 4). Two acoustic stations of the Marine Geophysical Survey Project are located on the abyssal plain. There is a wealth of core data available at Lamont from the plain; however, only a brief description is given here. The Blake-Bahama Abyssal Plain is covered by thick, coarse sands and sometimes gravels interstratified with carbonate-rich mud and clay. Coarse layers are common in most cores and are composed of fragmental biogenic carbonate. The material is derived from reefs associated with the Bahama Islands. Periodically, coarse debris from reefs slumps down steep insular slopes and accumulates as thick units covering the abyssal plain. The coarse layers have both massive and graded textures suggesting deposition by local submarine slumping and turbidity-current activity. Cores matched to the MGS stations are shown in Figure 4, whereas the area of gravel and sand derived from the Bahama Islands is given in Figure 5.

TURBIDITY CURRENT DEPOSITS AND THEIR BEARING ON THE DISTRIBUTION OF POTENTIAL REFLECTORS

Inspection of Figures 4 and 5 shows most reflectors are located within the limits of Hatteras Plain and associated gently sloping deep-sea fans. This portion of the western North Atlantic has been filled in and leveled by intermittent addition of coarse sediment by turbidity currents. Progressive burial of pre-existing topography has ultimately produced the flat surface of the plain. Every core from the plain is composed of turbidites interlayered with clay. The coarse layers are the only potential reflectors of sound within the sediment section penetrated by the cores. Therefore, in order to understand the reflectivity of the sea floor of this region it is important to understand the process which emplaced the sediments capable of reflecting sound. Several complete reviews and bibliographies covering the subject of turbidity currents are already available (e.g., Society of Economic Paleontologists and Mineralogists, Special Publication No. 2, 1951; Bally, 1957; Kuenen and Humbert, 1964; and Dzulynski and Walton, 1965).

It is not the purpose of this report to review the research done on turbidity flows. However, a very brief statement is included. Turbidity currents are dense clouds of suspended sediment triggered by natural phenomena such as earthquakes or slope failure due to overloading. After movement is initiated, bottom-seeking currents move downslope under the influence of gravity from

points of origin on the outer continental shelf or upper continental slope. Submarine canyons serve as main avenues of transfer. Currents often reach high velocities (e. g., 50 knots, Heezen and Ewing, 1952) and have the ability to transfer enormous volumes of sand and silt to abyssal depths in a short time. Forward momentum of flows is checked by decrease in gradient at the line of juncture of the continental rise and adjacent abyssal plain. These density currents have emplaced the sands and silts of Hatteras Plain.

Distribution of coarse sediment within the plain (Fig. 5) suggests Hudson and Hatteras Canyons have served as prime routes of flow of turbidity currents. Areas of sand lie at seaward ends of the canyons where velocity of the currents has been checked by an abrupt reduction of slope. Here sand is dropped from the advancing currents because lower velocities render impossible the maintenance of sand in suspension. Sand is limited to cores from Hudson and Hatteras Deep-Sea Fans, and areas immediately seaward (Figs. 4, 5).

Beyond deep-sea fans, velocities of turbidity currents are lower, flows advance more slowly, and the upper size limit of sediment carried in suspension is coarse silt. With farther and farther transport down the plain there is progressive slowing of the current and silt is dropped from suspension. These graded layers cover much of the middle and southern portions of Hatteras Plain (Fig. 5). The silts are distal equivalents of the sands.

There is a slight increase in thickness of many silt layers at the extreme southwestern corner of the abyssal plain. Currents which successfully negotiate the entire length of the plain appear to pond against abyssal hills. Heezen et al. (1967) suggested ponding occurs at the greatest depth attainable by turbidity currents. It is interesting to note there is not an equivalent thickening of silt units in the southeastern corner of the plain. This may be indirect evidence lending support to the idea that some turbidity currents spill out of Hatteras Abyssal Plain, pass through Vema Gap, and deposit sediment on Nares Abyssal Plain.

CONCLUSIONS

Sands and silts intercalated with clay dominate sediments of the Hatteras Abyssal Plain. The coarse layers have high velocity and wet density characteristics and offer sharp contrasts in acoustic impedance both at or just below the water-sediment interface.

Thickest and coarsest sands occur on the Hatteras and Hudson Deep-Sea Fans and immediately seaward of the fans. Where the sea floor is level and sand dominates, reflectivity should be very good. The central portion of the Hatteras Abyssal Plain is covered by sequences of alternating silt and clay. The silts offer multiple reflectors and over-all reflectivity should be good. At the extreme southwestern corner of the plain ponding of silt has taken place, potential reflectors are thicker, and sound reflection should be

good (slightly higher than that of the central area of the plain).

Based on the small number of cores available from the southeastern corner of the Hatteras Abyssal Plain, reflectivity should be moderate.

Cores taken immediately east, south, and southwest of the Hatteras Abyssal Plain consist of uniform, low velocity clay. Unless reflective horizons lie at depths greater than those reached by coring, sound reflection in these regions should be at a minimum.

Reflectivity should decrease in a landward direction within the limits of the outer continental rise. Prediction of the acoustic properties of the inner continental rise and, more particularly, the continental slope without detailed surveys of topography and sediments is not possible. Our survey reveals both bottom roughness and highly variable textural properties of sediments in these physiographic provinces present a poor and unpredictable acoustic interface.

The Blake-Bahama Abyssal Plain is covered with carbonate sands and gravels interstratified with carbonate-rich muds and clays. Cores suggest bottom reflectivity will be good.

Results of a survey of sediment cores from the Hatteras Abyssal Plain indicate submarine physiography and abyssal sedimentation may well control reflection of sound at the ocean floor. A single sedimentary process, the turbidity current, has leveled the region of the

abyssal plain providing an interface with perfect shape for sound reflection. In addition, turbidity currents have laid down inter-stratified coarse- and fine-grained layers, the former being potential surface and near-surface reflecting horizons. The survey lends weight in favor of the argument that, to predict sound reflection at the sea floor, it is first necessary to understand submarine physiography, sediment properties, and sediment processes (Heezen et al., 1967; Hamilton, 1969c; Horn et al., 1968b).

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APPENDIX A

CORE NUMBER, LOCATION, WATER DEPTH AND LENGTH OF CORE



Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-1	R12-3	25° 29' N	75° 59' W	2610	4773	32.2	980
2-2	V21-12	25° 23' N	74° 15' W	2665	4874	30.4	928
2-5	V21-233	25° 25' N	73° 03' W	2961	5416	30.8	938
2-7	V24-6	24° 58' N	71° 06' W	3020	5524	25.3	772
2-8	V24-5	28° 35' N	71° 05' W	2961	5415	30.4	928
2-9	RC4-2	28° 00' N	72° 59' W	2610	4773	29.1	888
2-10	V21-6	26° 42' N	73° 54' W	2509	4589	33.9	1033
2-11	A167-38	26° 23' N	76° 14' W	2530	4627	8.0	243
2-12	V15-199	27° 29' N	76° 05' W	2656	4857	31.1	949
2-13	NO MATCHED CORE						
2-14	V21-246	28° 31' N	75° 19' W	2721	4976	37.1	1132
2-15	A179-17	28° 00' N	73° 47' W	2400	4389	17.7	540
2-16	RC4-2	28° 00' N	72° 59' W	2610	4773	29.1	888
2-17	SHL80-3	28° 00' N	70° 30' W	2981	5452	11.6	353

Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-18	V7-33	29° 14' N	69° 55' W	2973	5437	23.1	705
2-19	RC9-11	29° 30' N	72° 18' W	2850	5212	41.2	1257
2-20	RC2-1	29° 48' N	74° 19' W	2478	4532	36.3	1107
2-21	A164-29	29° 45' N	75° 21' W	2531	4630	12.2	372
2-22	NO MATCHED CORE						
2-23	RC4-8	30° 38' N	76° 16' W	2049	3748	18.8	572
2-24	R12-7	31° 41' N	76° 07' W	1500	2743	30.2	920
2-25	V15-207	31° 11' N	75° 06' W	1873	3426	37.9	1154
2-26	A167-10	31° 47' N	73° 24' W	2750	5029	17.0	517
2-27	V15-2	32° 12' N	74° 10' W	2680	4901	5.5	168
2-28	R12-7	31° 41' N	76° 07' W	1500	2743	30.2	920
2-29	RC9-4	33° 19' N	75° 13' W	1942	3552	31.7	965
2-30	RC9-4	33° 19' N	75° 13' W	1942	3552	31.7	965
2-31	V22-2	39° 15' N	73° 12' W	2895	5295	7.6	232

Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-32	SHL80-2	33° 08' N	71° 25' W	2942	5381	15.8	483
2-33	V21-248	32° 39' N	72° 39' W	2903	5309	7.4	227
2-34	V7-34	31° 17' N	71° 05' W	2952	5400	16.1	490
2-35	V26-169	31° 14' N	69° 52' W	2966	5424	39.0	1190
2-36	V10-99	31° 29' N	68° 03' W	2978	5446	16.1	490
2-37	A179-21	32° 18' N	68° 51' W	2798	5118	16.1	490
2-38	V19-4	32° 36' N	71° 19' W	2948	5391	33.0	1007
2-39	RC10-287	33° 36' N	71° 10' W	2923	5347	38.1	1162
2-40	RC10-287	33° 36' N	71° 10' W	2923	5347	38.1	1162
2-41	RC9-3	33° 38' N	72° 09' W	2826	5169	32.2	980
2-42	NO MATCHED CORE						
2-43	RC7-1	35° 10' N	73° 52' W	1861	3404	37.9	1155
2-44	RC10-288	35° 31' N	73° 24' W	2011	3678	28.3	862
2-45	V24-2	34° 26' N	71° 42' W	2499	4570	4.0	123

Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-46	V24-1	36° 30' N	73° 30' W	1647	3012	12.2	373
2-47	A164-33	36° 54' N	73° 58' W	1397	2556	7.1	216
2-48	A167-1	37° 39' N	72° 58' W	1479	2706	25.6	780
2-49	RC10-289	37° 00' N	72° 32' W	1735	3173	37.8	1151
2-51	V21-2	36° 05' N	70° 24' W	2436	4455	6.7	203
2-52	A150-35	36° 21' N	67° 46' W	2687	4914	4.0	123
2-53	A164-19	36° 46' N	67° 23' W	2738	5007	9.4	285
2-54	A164-35	33° 30' N	67° 48' W	2816	5151	13.2	402
2-55	A179-21	32° 18' N	68° 51' W	2798	5118	16.1	490
2-56	A179-21	32° 18' N	68° 51' W	2798	5118	16.1	490
2-57	V18-368	33° 03' N	69° 42' W	2944	5385	9.5	290
2-58	A164-35	33° 30' N	67° 48' W	2816	5151	13.2	402
2-59	NO MATCHED CORE						
2-60	A179-23	34° 56' N	16° 15' W	2760	5048	20.0	610

Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-61	A179-22	34° 07' N	68° 20' W	2798	5118	6.2	188
2-62	A167-4	34° 57' N	70° 05' W	2650	4846	17.1	522
2-63	A164-17	35° 47' N	68° 56' W	2638	4824	23.2	706
2-64	A164-13	35° 43' N	67° 20' W	2790	5103	7.4	225
2-65	A172-33	36° 43' N	68° 32' W	2570	4700	16.1	490
2-66	V20-253	38° 17' N	68° 32' W	2673	4889	39.3	1197
2-67	V23-145	37° 05' N	69° 36' W	2378	4349	28.5	870
2-68	A185-63	37° 48' N	72° 03' W	1330	2433	16.1	490
2-69	V15-213	38° 56' N	72° 03' W	1340	2450	17.3	526
2-70	V13-1	38° 38' N	70° 42' W	1660	3036	32.2	980
2-71	A164-61	39° 33' N	68° 47' W	1488	2722	14.0	428
2-72	A164-61	39° 33' N	68° 47' W	1488	2722	14.0	428
2-73	C25-2	40° 11' N	67° 38' W	960	1756	12.4	378
2-74	V7-69	40° 46' N	65° 33' W	1626	2974	20.1	612

Location, Depths and Lengths of Cores

MGS Area & Station	Core No.	Location		Water Depth		Core Length	
		Latitude	Longitude	Fathoms	Meters	Feet	Cm.
2-75	NO MATCHED CORE						
2-76	A164-57	39° 20' N	67° 13' W	1853	3390	16.3	497
2-77	A164-59	38° 42' N	67° 52' W	2222	4064	15.2	464
2-78	A173-2	38° 30' N	66° 01' W	2449	4480	29.9	910
2-79	A173-3	37° 50' N	66° 22' W	2683	4907	16.1	490
2-80	V20-252	37° 14' N	66° 32' W	2729	4991	37.7	1149
2-81	V23-143	36° 39' N	66° 11' W	2735	5002	25.3	772
2-82	A164-14	36° 06' N	67° 19' W	2720	4974	17.0	518
2-83	V12-1	34° 38' N	66° 36' W	2847	5207	40.2	1225
2-84	V12-1	34° 38' N	66° 36' W	2847	5207	40.2	1225

APPENDIX B

GRAIN SIZE DATA USED TO PREDICT SOUND VELOCITIES AND WET
DENSITIES OF LAYERS FROM MEAN GRAIN SIZES OF SEDIMENTS

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$		σ_I	Sk_I	K'_G
								ϕ	μ			
MGs 2-1												
R12-3	4773	55	0.00	55.62	29.27	15.11	.66	4.78	36.10	2.52	+ .66	.69
		175	1.51	75.69	10.88	11.92	.48	2.80	143.20	2.98	+ .53	.65
		425	5.30	79.40	6.31	8.99	.41	1.32	400.00	2.77	+ .57	.71
MGs 2-2												
V21-12	4874	0	0.00	1.35	26.90	71.75	.27	9.69	1.21	2.69	- .05	.46
		820	0.00	.43	22.85	76.72	.23	10.21	.84	2.73	- .21	.47
		900	0.00	.00	18.25	81.75	.18	10.32	.78	2.38	- .06	.46
MGs 2-5												
V21-233	5416	230	0.00	.48	33.05	66.47	.33	9.68	1.22	2.76	- .04	.44
		257	0.00	.73	80.48	18.79	.81	6.20	13.60	2.19	+ .69	.65
		381	0.00	2.40	85.74	11.86	.88	5.33	24.80	1.78	+ .72	.72
		673	0.00	4.20	35.18	60.62	.37	9.13	1.78	2.65	+ .13	.55
		687	0.00	28.70	53.18	18.12	.75	5.57	20.90	2.51	+ .67	.61
		900	0.00	6.10	37.83	56.07	.40	8.62	2.52	3.31	- .01	.43

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	μ	σ_I	Sk_I	K'_G
MGS 2-7												
V24-6	5524	0	0.00	.02	26.66	73.32	.27	9.87	1.07	2.54	.00	.44
		113	0.00	17.80	76.89	5.31	.94	4.67	39.20	1.13	+ .53	.66
		410	0.00	.05	12.15	87.80	.12	10.64	.63	2.13	- .05	.45
		449	0.00	.03	89.52	10.45	.90	6.18	13.79	1.35	+ .46	.69
		510	0.00	8.30	89.26	2.44	.97	4.60	41.10	.60	+ .36	.57
MGS 2-8												
V24-5	5415	0	0.00	.04	31.42	68.54	.31	9.68	1.22	2.59	+ .04	.43
		85	0.00	4.20	87.48	8.32	.91	4.76	36.80	1.17	+ .56	.76
		482	0.00	.16	23.49	76.35	.24	10.05	.94	2.34	+ .05	.43
		498	0.00	1.70	95.25	3.05	.97	4.73	37.50	.57	+ .56	.58
MGS 2-9, MGS 2-16												
RC4-2	4773	0	0.00	.93	17.10	81.97	.17	10.17	.86	2.27	+ .08	.45
		860	0.00	.01	20.54	79.45	.21	9.92	1.03	2.77	- .15	.49

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi \quad \mu}$		σ_I	Sk_I	K'_G
MGS 2-10												
V21-6	4589	0	0.00	2.30	17.16	80.54	.18	10.15	.88	2.58	-.08	.50
		72	0.00	.01	13.50	86.49	.14	10.45	.71	2.15	+0.04	.44
		930	0.00	.60	15.05	84.35	.15	10.17	.87	2.20	+0.15	.46
MGS 2-11												
A167-38	4627	20	0.00	4.32	58.60	37.08	.61	7.22	6.67	2.94	+0.57	.43
		82	0.00	.07	17.01	82.92	.17	10.32	.78	2.25	+0.03	.42
		208	0.00	75.00	15.57	9.43	.62	3.45	91.00	2.07	+0.53	.70
MGS 2-12												
V15-199	4857	0	0.00	14.60	31.36	54.04	.37	8.21	3.36	3.54	-.08	.41
		160	0.00	.94	29.68	69.38	.30	9.58	1.30	2.78	-.05	.45
		320	0.00	34.50	53.13	12.37	.81	4.78	36.20	2.03	+0.54	.69
MGS 2-13	NO MATCHED CORE											

GRAIN SIZE DATA

[illegible]

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk_I	K'_G
MGS 2-18											
V7-33	5437	76	0.00	1.76	80.30	17.94	.82	6.19	13.69	2.22	.66
		353	0.00	71.90	21.10	7.00	.75	3.71	76.20	1.47	.73
		391	0.00	74.60	16.60	8.80	.65	3.53	86.50	1.83	.72
		435	0.00	.17	40.39	59.44	.40	9.10	1.82	2.76	.42
		535	0.00	24.18	61.86	13.96	.82	5.23	26.52	2.09	.68
		580	0.00	69.10	26.96	3.94	.87	3.65	79.20	.95	.62
MGS 2-19											
RC9-11	5212	0	0.00	.12	34.59	65.29	.35	9.28	1.60	2.72	.42
		545	0.00	.00	15.70	84.30	.16	10.46	.71	2.19	.43
		555	0.00	.15	69.80	30.05	.70	7.44	5.73	2.74	.49
MGS 2-20											
RC2-1	4532	40	0.00	2.05	18.19	79.76	.19	10.12	.89	2.47	.47
		1050	0.00	.04	13.65	86.31	.14	10.46	.71	2.17	.45

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk _I	K _G '
MGS 2-21											
A164-29	4630	85	0.00	.11	12.96	86.93	.13	10.53	2.16	.00	.44
MGS 2-22	NO MATCHED CORE										
MGS 2-23											
RC4-8	3748	100	0.00	.04	23.34	76.62	.23	10.17	2.44	-.05	.43
MGS 2-24, MGS 2-28											
R12-7	2820	200	0.00	2.00	29.81	68.19	.30	9.55	2.66	+ .02	.45
MGS 2-25											
V15-207	3426	0	0.00	4.40	29.95	65.65	.31	9.12	2.97	-.01	.48
MGS 2-26											
A167-10	5029	5	0.00	.60	32.33	67.07	.33	9.45	2.68	+ .05	.44
		472	0.00	1.90	93.82	4.28	.96	5.07	.88	+ .36	.61
MGS 2-27											
V15-2	4901	82	0.00	.10	48.19	51.71	.48	8.77	2.66	+ .30	.46
		130	0.00	3.66	93.39	2.95	.97	4.81	.64	+ .34	.55

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi \quad \mu}$		σ_I	Sk_I	K'_G
MGS 2-29, MGS 2-30												
RC9-4	3552	0	0.00	4.87	31.20	63.93	.33	9.16	1.74	2.94	+0.01	.48
		911	0.00	.44	34.34	65.22	.34	9.44	1.44	2.70	+0.07	.44
MGS 2-31												
V22-2	5295	10	0.00	19.80	73.32	6.88	.91	4.52	43.20	1.33	+0.61	.77
		72	0.00	80.89	14.98	4.13	.78	3.78	72.70	.66	+0.21	.75
		108	0.00	3.83	44.44	51.73	.46	8.28	3.21	3.24	+0.09	.43
		170	0.00	71.90	22.28	5.82	.79	3.83	69.90	1.19	+0.42	.80
MGS 2-32												
SHL80-2	5381	0	0.00	1.19	47.99	50.82	.49	8.27	3.23	3.04	+0.18	.42
		55	0.00	.35	63.89	35.76	.64	7.50	5.49	2.88	+0.60	.43
		212	0.00	48.80	32.38	18.82	.63	5.30	25.20	3.07	+0.62	.56
		379	0.00	23.40	74.07	2.53	.97	4.34	49.30	.55	+0.34	.60
		475	0.00	66.53	30.39	3.08	.91	3.96	63.80	.43	+0.18	.62

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk _I	K _G [']
MGS 2-41											
RC9-3	5169	45	0.00	.23	39.97	59.80	.40	9.05	2.84	+ .07	.44
		610	0.00	.06	80.05	19.89	.80	6.81	2.23	+ .65	.65
		650	0.00	.06	33.55	66.39	.34	9.18	3.27	- .23	.36
MGS 2-42	NO MATCHED CORE										
MGS 2-43											
RC7-1	3404	0	0.00	21.90	36.26	41.84	.46	7.43	3.44	+ .19	.42
		165	0.00	27.20	37.56	35.24	.52	6.69	3.32	+ .31	.44
		303	5.42	61.52	20.79	12.27	.63	2.16	3.65	+ .80	.52
		425	0.00	19.70	42.69	37.61	.53	7.34	3.40	+ .29	.42
		441	0.00	89.50	8.24	2.26	.78	3.36	.52	+ .21	.60
		570	0.00	.82	47.90	51.28	.48	8.60	2.86	+ .24	.44
		670	0.00	24.10	48.54	27.36	.64	6.13	2.94	+ .61	.47
		1138	0.00	17.81	42.40	39.79	.52	7.25	3.32	+ .27	.44

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi \quad \mu}$		σ_I	Sk _I	K' _G
MGS 2-44												
RC10-288	3678	5	0.00	4.30	35.18	60.52	.37	8.84	2.17	2.98	+0.02	.47
		511	0.00	.62	32.31	67.07	.33	9.51	1.37	2.62	+1.11	.45
		522	0.00	48.80	28.13	23.07	.55	5.65	19.78	3.10	+7.75	.49
MGS 2-45												
V24-2	4570	40	0.00	2.88	22.52	74.60	.23	9.88	1.06	2.60	+0.01	.47
MGS 2-46												
V24-1	3012	6	0.00	3.98	38.31	57.71	.40	8.51	2.74	3.04	+0.01	.46
		170	0.00	1.59	34.42	63.99	.35	9.36	1.52	2.66	+1.13	.46
		350	0.00	.24	29.42	70.34	.29	9.62	1.26	2.76	-.03	.44
MGS 2-47												
A164-33	2556	0	0.00	8.30	57.50	34.20	.63	6.95	8.06	2.83	+3.38	.47
		72	0.00	1.14	77.58	21.28	.78	6.45	11.38	2.44	+6.69	.58
		178	0.00	31.50	59.04	9.46	.86	4.48	44.60	1.43	+5.57	.75

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk_I	K'_G
MGS 2-53											
A164-19	5007	35	0.00	44.30	50.09	5.61	.90	4.03	1.08	+ .29	.76
		265	0.00	46.52	47.93	5.55	.90	3.96	1.03	+ .42	.76
MGS 2-54, MGS 2-58											
A164-35	5151	0	0.00	2.80	25.25	71.95	.26	9.63	2.71	- .01	.47
		130	0.00	.02	13.07	86.91	.13	10.59	2.23	- .06	.47
MGS 2-57											
V18-368	5385	0	0.00	1.19	26.12	72.69	.26	9.78	2.67	- .02	.46
		85	0.00	.78	40.96	58.26	.41	9.07	2.88	+ .08	.43
		271	0.00	.05	19.35	80.60	.19	9.56	1.99	- .45	.47
MGS 2-59 NO MATCHED CORE											
MGS 2-60											
A179-23	5048	25	0.00	93.00	4.71	2.29	.67	2.67	.81	+ .21	.53
		428	0.00	95.52	2.81	1.67	.63	2.36	.73	+ .26	.52
		440	0.00	1.42	46.24	52.34	.47	8.56	2.95	+ .19	.43

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk_I	K'_G
MGS 2-61											
A179-22	5118	0	0.00	1.82	29.54	68.64	.30	9.43	2.73	+0.02	.46
		55	0.00	73.90	23.87	2.23	.91	3.64	.79	+0.32	.61
		115	0.00	89.10	10.19	.71	.93	3.28	.56	+0.06	.51
		169	0.00	87.60	10.49	1.91	.85	3.24	.83	+0.26	.63
MGS 2-62											
A167-4	4846	100	0.00	.27	27.84	71.89	.28	9.75	2.58	.00	.44
		432	0.00	24.90	44.56	30.54	.59	6.40	3.26	+0.39	.46
MGS 2-63											
A164-17	4824	115	0.00	.03	28.50	71.47	.29	9.72	2.64	+0.01	.44
MGS 2-64											
A164-13	5103	0	0.00	2.23	34.10	63.67	.35	9.25	2.84	+0.04	.46
		40	0.00	89.60	7.43	2.97	.71	2.97	.92	+0.23	.58
		58	0.00	94.25	3.93	1.82	.68	2.76	.64	+0.29	.52

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi \quad \mu}$		σ_I	Sk_I	K'_G
A164-13	5103	120	0.00	95.90	3.40	.70	.83	2.53	173.10	.72	+ .15	.52
		130	0.00	93.71	4.40	1.89	.70	2.61	163.40	.77	+ .27	.56
		213	0.00	92.50	5.12	2.38	.68	2.65	158.50	.81	+ .40	.57
MGS 2-65												
A172-33	4700	0	0.00	3.25	55.42	41.33	.57	7.87	4.25	2.97	+ .31	.49
		70	0.00	68.70	29.57	1.73	.94	3.76	73.80	.63	+ .18	.54
		150	0.00	.91	32.34	66.75	.33	9.39	1.48	2.87	- .05	.45
		299	0.00	18.40	72.60	9.00	.89	4.76	36.80	1.49	+ .68	.73
		380	0.00	17.39	56.58	26.03	.68	6.38	12.00	2.78	+ .43	.49
MGS 2-66												
V20-253	4889	15	0.00	4.40	51.24	44.36	.54	8.13	3.54	3.05	+ .26	.44
		315	0.00	80.60	18.45	.95	.95	3.60	82.20	.46	+ .33	.53
		625	0.00	.08	25.41	74.51	.25	9.92	1.03	2.47	+ .04	.44
		1173	0.00	87.30	11.21	1.49	.88	3.51	87.70	.41	+ .35	.57

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi \quad \mu}$		σ_I	Sk_I	K'_G
MGS 2-67												
V23-145	4349	5	0.00	1.90	40.64	57.46	.41	8.89	2.09	2.80	+ .13	.45
		124	0.00	87.50	10.63	1.87	.85	2.94	130.00	1.10	- .32	.48
		712	0.00	75.00	18.09	6.91	.72	3.54	85.70	1.43	+ .38	.75
		836	0.00	.23	30.20	69.57	.30	9.59	1.30	2.61	+ .05	.44
MGS 2-68												
A185-63	2433	100	0.00	1.41	37.07	61.52	.38	9.02	1.92	3.10	- .05	.44
		400	0.00	2.26	38.33	59.41	.39	8.97	1.98	2.99	+ .05	.43
MGS 2-69												
V15-213	2450	51	0.00	9.10	42.38	48.52	.47	8.09	3.65	3.42	+ .08	.44
		500	0.00	2.62	37.36	60.02	.38	8.97	1.98	3.00	.00	.44
MGS 2-70												
V13-1	3036	5	0.00	5.10	46.78	48.12	.49	8.20	3.39	2.80	+ .14	.52
		940	0.00	2.94	42.66	54.40	.44	8.49	2.77	3.09	+ .05	.45

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	μ	σ_I	Sk_I	K'_G
MGS 2-71, MGS 2-72												
A164-61	2722	170	0.00	1.35	34.72	63.93	.35	9.16	1.74	2.93	+ .02	.45
		216	0.00	92.30	6.26	1.44	.81	3.25	104.60	.46	+ .13	.55
MGS 2-73												
C25-2	1756	100	0.00	6.19	44.24	49.57	.47	8.29	3.18	3.17	+ .15	.45
MGS 2-74												
V7-69	2974	25	0.29	24.01	39.06	36.64	.52	6.84	8.68	3.45	+ .29	.45
		468	0.00	4.21	56.08	39.71	.59	7.65	4.95	3.03	+ .33	.45
MGS 2-75 NO MATCHED CORE												
MGS 2-76												
A164-57	3390	160	0.57	6.43	36.15	56.85	.39	8.67	2.44	3.24	.00	.45
MGS 2-77												
A164-59	4064	50	0.00	15.15	43.85	41.00	.52	7.44	5.71	3.23	+ .27	.42
		153	0.00	90.35	7.02	2.63	.73	3.12	114.40	.73	+ .06	.55
		370	0.00	29.31	51.87	18.82	.73	5.73	18.75	2.61	+ .77	.62

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{M_z}{\phi}$	μ	σ_I	Sk _I	K' _G
MGS 2-78												
A173-2	4480	45	0.00	8.51	52.68	38.81	.58	7.45	5.70	3.19	+ .37	.42
		624	0.00	.03	26.47	73.50	.26	9.97	1.00	2.27	+ .17	.41
		625	0.00	.00	76.29	23.71	.76	7.27	6.46	2.28	+ .65	.60
		828	0.00	7.22	90.36	2.42	.97	4.35	48.80	.32	+ .27	.64
		839	0.00	82.28	14.79	2.93	.83	3.55	85.30	.67	+ .20	.60
		852	0.00	94.89	3.71	1.40	.73	2.92	131.50	.58	+ .05	.53
MGS 2-79												
A173-3	4709	210	0.00	1.29	35.23	63.48	.36	9.29	1.60	2.91	- .01	.43
		312	0.00	67.65	27.31	5.04	.84	2.67	157.10	.79	+ .37	.55
		374	0.00	91.30	7.18	1.52	.83	3.94	65.10	.93	+ .40	.77
MGS 2-80												
V20-252	4991	10	0.00	31.68	36.56	31.76	.54	6.03	15.23	4.09	+ .16	.43
		50	0.00	14.70	38.14	47.16	.45	7.95	4.03	3.71	+ .02	.46

GRAIN SIZE DATA

Core No.	Depth (m)	Depth in Core(cm)	% Gravel	% Sand	% Silt	% Clay	$\frac{z}{z+c}$	$\frac{Mz}{\phi}$	σ_I	Sk _I	K' _G	
MGS 2-82												
A164-14	4974	25	0.00	79.80	15.93	4.27	.79	3.40	94.20	1.03	+.40	.67
		78	0.00	89.60	6.28	4.12	.60	2.67	156.00	1.15	+.46	.70
		100	0.00	.99	49.33	49.68	.50	8.18	3.43	3.46	+.19	.35
		190	0.00	10.50	81.72	7.78	.91	4.82	35.20	1.48	+.62	.73
		287	0.00	66.87	22.49	10.64	.68	4.23	52.90	1.84	+.67	.76
		310	0.00	80.50	11.87	7.63	.61	3.58	83.20	1.41	+.55	.81
		350	0.00	93.70	3.95	2.35	.63	2.78	145.20	.64	+.25	.53
MGS 2-83, MGS 2-84												
V12-1	5207	50	0.00	.03	37.05	62.92	.37	9.30	1.58	2.72	+.10	.42
		400	0.00	.15	33.52	66.33	.34	9.33	1.55	2.68	+.06	.44
		1008	0.00	1.03	9.37	89.60	.09	10.63	.63	2.19	-.05	.47

APPENDIX C

TABLE OF PREDICTED SOUND VELOCITIES AND WET DENSITIES
BASED UPON MEAN GRAIN SIZES OF SEDIMENTS
(ALL DATA ARE ADJUSTED TO 23° CENTIGRADE)

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

m/sec	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	ft/sec	m/sec			ft/sec	m/sec		
1497	4911		-	1.18-1.19	5223	1592	14.0	1.89
1496	4907		0.50	1.20-1.22	5238	1596	15.0	1.89
1495	4905		-	1.23-1.25	5251	1601	16.0	1.90
1494	4902		-	1.26-1.29	5264	1605	17.0	1.91
1493	4898		-	1.30-1.34	5277	1608	18.0	1.92
1492	4895		-	1.35-1.41	5289	1612	19.0	1.92
1493	4898		-	1.42-1.45	5300	1616	20.0	1.93
1494	4902		-	1.46-1.48	5311	1619	21.0	1.94
1495	4906		0.75	1.49	5322	1622	22.0	1.94
1497	4911		1.00	1.52	5333	1625	23.0	1.95
1500	4920		1.25	1.55	5343	1628	24.0	1.95
1502	4929		1.50	1.57	5353	1631	25.0	1.96
1505	4939		1.75	1.60	5362	1634	26.0	1.96
1508	4948		2.0	1.62	5371	1637	27.0	1.97
1514	4967		2.5	1.65	5380	1640	28.0	1.97
1519	4985		3.0	1.68	5389	1643	29.0	1.98
1525	5002		3.5	1.70	5398	1645	30.0	1.98
1529	5018		4.0	1.72	5406	1648	31.0	1.98
1538	5047		5.0	1.75	5414	1651	32.0	1.99
1546	5073		6.0	1.78	5422	1653	33.0	1.99
1554	5097		7.0	1.80	5430	1655	34.0	1.99
1560	5119		8.0	1.81	5437	1657	35.0	2.00
1566	5139		9.0	1.83	5445	1660	36.0	2.00
1572	5158		10.0	1.84	5452	1662	37.0	2.00
1578	5176		11.0	1.86	5459	1664	38.0	2.01
1583	5193		12.0	1.87	5466	1666	39.0	2.01
1588	5208		13.0	1.88	5473	1668	40.0	2.01

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	m/sec	ft/sec			m/sec	ft/sec		
1670		5479	41.0	2.02	1714	5625	68.0	2.07
1672		5486	42.0	2.02	1716	5629	69.0	2.07
1674		5492	43.0	2.02	1717	5634	70.0	2.08
1676		5499	44.0	2.02	1718	5638	71.0	2.08
1678		5505	45.0	2.03	1720	5642	72.0	2.08
1680		5511	46.0	2.03	1721	5647	73.0	2.08
1682		5517	47.0	2.03	1722	5651	74.0	2.08
1683		5523	48.0	2.03	1724	5655	75.0	2.08
1685		5529	49.0	2.04	1725	5659	76.0	2.09
1687		5535	50.0	2.04	1726	5663	77.0	2.09
1689		5540	51.0	2.04	1727	5667	78.0	2.09
1690		5546	52.0	2.04	1729	5671	79.0	2.09
1692		5551	53.0	2.04	1730	5675	80.0	2.09
1694		5557	54.0	2.05	1731	5679	81.0	2.09
1695		5562	55.0	2.05	1732	5683	82.0	2.09
1697		5567	56.0	2.05	1733	5687	83.0	2.09
1698		5572	57.0	2.05	1734	5690	84.0	2.10
1700		5577	58.0	2.06	1736	5694	85.0	2.10
1702		5583	59.0	2.06	1737	5698	86.0	2.10
1703		5587	60.0	2.06	1738	5701	87.0	2.10
1705		5592	61.0	2.06	1739	5705	88.0	2.10
1706		5597	62.0	2.06	1740	5709	89.0	2.10
1707		5602	63.0	2.06	1741	5712	90.0	2.10
1709		5607	64.0	2.07	1742	5716	91.0	2.10
1710		5611	65.0	2.07	1743	5719	92.0	2.11
1712		5616	66.0	2.07	1744	5723	93.0	2.11
1713		5620	67.0	2.07	1745	5726	94.0	2.11

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

m/sec	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	m/sec	ft/sec			m/sec	ft/sec		
1746		5730	95.0	2.11	1772	5812	122.0	2.14
1747		5733	96.0	2.11	1772	5815	123.0	2.14
1748		5736	97.0	2.11	1773	5818	124.0	2.14
1749		5740	98.0	2.11	1774	5821	125.0	2.14
1750		5743	99.0	2.11	1775	5823	126.0	2.14
1751		5746	100.0	2.11	1776	5826	127.0	2.14
1752		5750	101.0	2.11	1777	5829	128.0	2.14
1753		5753	102.0	2.12	1777	5831	129.0	2.14
1754		5756	103.0	2.12	1778	5834	130.0	2.14
1755		5759	104.0	2.12	1779	5837	131.0	2.14
1756		5762	105.0	2.12	1780	5839	132.0	2.14
1757		5765	106.0	2.12	1781	5842	133.0	2.14
1758		5768	107.0	2.12	1781	5844	134.0	2.14
1759		5772	108.0	2.12	1782	5847	135.0	2.15
1760		5775	109.0	2.12	1783	5849	136.0	2.15
1761		5778	110.0	2.12	1784	5852	137.0	2.15
1762		5781	111.0	2.13	1784	5854	138.0	2.15
1763		5784	112.0	2.13	1785	5857	139.0	2.15
1764		5787	113.0	2.13	1786	5859	140.0	2.15
1765		5789	114.0	2.13	1787	5862	141.0	2.15
1766		5792	115.0	2.13	1787	5864	142.0	2.15
1766		5795	116.0	2.13	1788	5867	143.0	2.15
1767		5797	117.0	2.13	1789	5869	144.0	2.15
1768		5801	118.0	2.13	1790	5872	145.0	2.15
1769		5804	119.0	2.13	1790	5874	146.0	2.15
1770		5807	120.0	2.13	1791	5876	147.0	2.15
1771		5810	121.0	2.13	1792	5879	148.0	2.16

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	m/sec	ft/sec			m/sec	ft/sec		
1793	1811	5881	149.0	2.16	1811	5940	176.0	2.17
1793	1811	5883	150.0	2.16	1811	5942	177.0	2.17
1794	1812	5886	151.0	2.16	1812	5944	178.0	2.18
1795	1812	5888	152.0	2.16	1812	5946	179.0	2.18
1795	1813	5890	153.0	2.16	1813	5948	180.0	2.18
1796	1814	5893	154.0	2.16	1814	5950	181.0	2.18
1797	1814	5895	155.0	2.16	1814	5952	182.0	2.18
1797	1815	5897	156.0	2.16	1815	5954	183.0	2.18
1798	1815	5900	157.0	2.16	1815	5956	184.0	2.18
1799	1816	5902	158.0	2.16	1816	5958	185.0	2.18
1800	1817	5904	159.0	2.16	1817	5960	186.0	2.18
1800	1817	5906	160.0	2.16	1817	5962	187.0	2.18
1801	1818	5908	161.0	2.16	1818	5964	188.0	2.18
1802	1818	5911	162.0	2.16	1818	5966	189.0	2.18
1802	1819	5913	163.0	2.16	1819	5968	190.0	2.18
1803	1820	5915	164.0	2.17	1820	5970	191.0	2.18
1804	1820	5917	165.0	2.17	1820	5972	192.0	2.18
1804	1821	5919	166.0	2.17	1821	5974	193.0	2.18
1805	1821	5921	167.0	2.17	1821	5976	194.0	2.18
1806	1822	5924	168.0	2.17	1822	5977	195.0	2.18
1806	1823	5926	169.0	2.17	1823	5979	196.0	2.18
1807	1823	5928	170.0	2.17	1823	5981	197.0	2.19
1808	1824	5930	171.0	2.17	1824	5983	198.0	2.19
1808	1824	5932	172.0	2.17	1824	5985	199.0	2.19
1809	1825	5934	173.0	2.17	1825	5987	200.0	2.19
1809	1825	5936	174.0	2.17	1825	5989	201.0	2.19
1810	1826	5938	175.0	2.17	1826	5990	202.0	2.19

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

m/sec	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	ft/sec	m/sec			ft/sec	m/sec		
1826	5992	1841	203.0	2.19	6039	1841	230.0	2.20
1827	5994	1841	204.0	2.19	6040	1841	231.0	2.20
1828	5996	1842	205.0	2.19	6042	1842	232.0	2.20
1828	5998	1842	206.0	2.19	6044	1842	233.0	2.20
1829	5999	1843	207.0	2.19	6045	1843	234.0	2.20
1829	6001	1843	208.0	2.19	6047	1843	235.0	2.20
1830	6003	1844	209.0	2.19	6048	1844	236.0	2.21
1830	6005	1844	210.0	2.19	6050	1844	237.0	2.21
1831	6006	1845	211.0	2.19	6052	1845	238.0	2.21
1831	6008	1845	212.0	2.19	6053	1845	239.0	2.21
1832	6010	1845	213.0	2.19	6055	1845	240.0	2.21
1832	6012	1846	214.0	2.19	6056	1846	241.0	2.21
1833	6013	1846	215.0	2.20	6058	1846	242.0	2.21
1833	6015	1847	216.0	2.20	6059	1847	243.0	2.21
1834	6017	1847	217.0	2.20	6061	1847	244.0	2.21
1834	6019	1848	218.0	2.20	6063	1848	245.0	2.21
1835	6020	1848	219.0	2.20	6064	1848	246.0	2.21
1836	6022	1849	220.0	2.20	6066	1849	247.0	2.21
1836	6024	1849	221.0	2.20	6067	1849	248.0	2.21
1837	6025	1850	222.0	2.20	6069	1850	249.0	2.21
1837	6027	1850	223.0	2.20	6070	1850	250.0	2.21
1838	6029	1853	224.0	2.20	6078	1853	255.0	2.21
1838	6030	1855	225.0	2.20	6085	1855	260.0	2.21
1839	6032	1857	226.0	2.20	6092	1857	265.0	2.22
1839	6034	1859	227.0	2.20	6100	1859	270.0	2.22
1840	6035	1861	228.0	2.20	6107	1861	275.0	2.22
1840	6037	1863	229.0	2.20	6114	1863	280.0	2.22

MEAN GRAIN SIZE, WET DENSITY AND EQUIVALENT SOUND VELOCITIES

m/sec	Velocity		Mean Size μ	Wet Density g/cc	Velocity		Mean Size μ	Wet Density g/cc
	ft/sec	m/sec			ft/sec	m/sec		
1866	6121	1866	285.0	2.22	6275	1913	420.0	2.26
1868	6127	1868	290.0	2.23	6280	1914	425.0	2.26
1870	6134	1870	295.0	2.23	6285	1916	430.0	2.27
1872	6141	1872	300.0	2.23	6290	1917	435.0	2.27
1874	6147	1874	305.0	2.23	6295	1919	440.0	2.27
1876	6153	1876	310.0	2.23	6299	1920	445.0	2.27
1877	6160	1877	315.0	2.23	6304	1921	450.0	2.27
1879	6166	1879	320.0	2.24	6309	1923	455.0	2.27
1881	6172	1881	325.0	2.24	6313	1924	460.0	2.27
1883	6178	1883	330.0	2.24	6318	1926	465.0	2.27
1885	6184	1885	335.0	2.24	6322	1927	470.0	2.27
1887	6190	1887	340.0	2.24	6326	1928	475.0	2.27
1888	6196	1888	345.0	2.24	6331	1930	480.0	2.27
1890	6202	1890	350.0	2.24	6335	1931	485.0	2.28
1892	6207	1892	355.0	2.25	6339	1932	490.0	2.28
1894	6213	1894	360.0	2.25	6344	1934	495.0	2.28
1895	6218	1895	365.0	2.25	6348	1935	500.0	2.28
1897	6224	1897	370.0	2.25				
1899	6229	1899	375.0	2.25				
1900	6235	1900	380.0	2.25				
1902	6240	1902	385.0	2.25				
1904	6245	1904	390.0	2.26				
1905	6250	1905	395.0	2.26				
1907	6255	1907	400.0	2.26				
1908	6261	1908	405.0	2.26				
1910	6266	1910	410.0	2.26				
1911	6271	1911	415.0	2.26				

APPENDIX D

CORE DATA MATCHED TO ACOUSTIC STATIONS OF ALPINE
GEOPHYSICAL ASSOCIATES, AREA 2 - ATLANTIC,
MARINE GEOPHYSICAL SURVEY PROJECT
U.S. NAVAL OCEANOGRAPHIC OFFICE

LEGEND TO ACCOMPANY APPENDIX D

Lithology



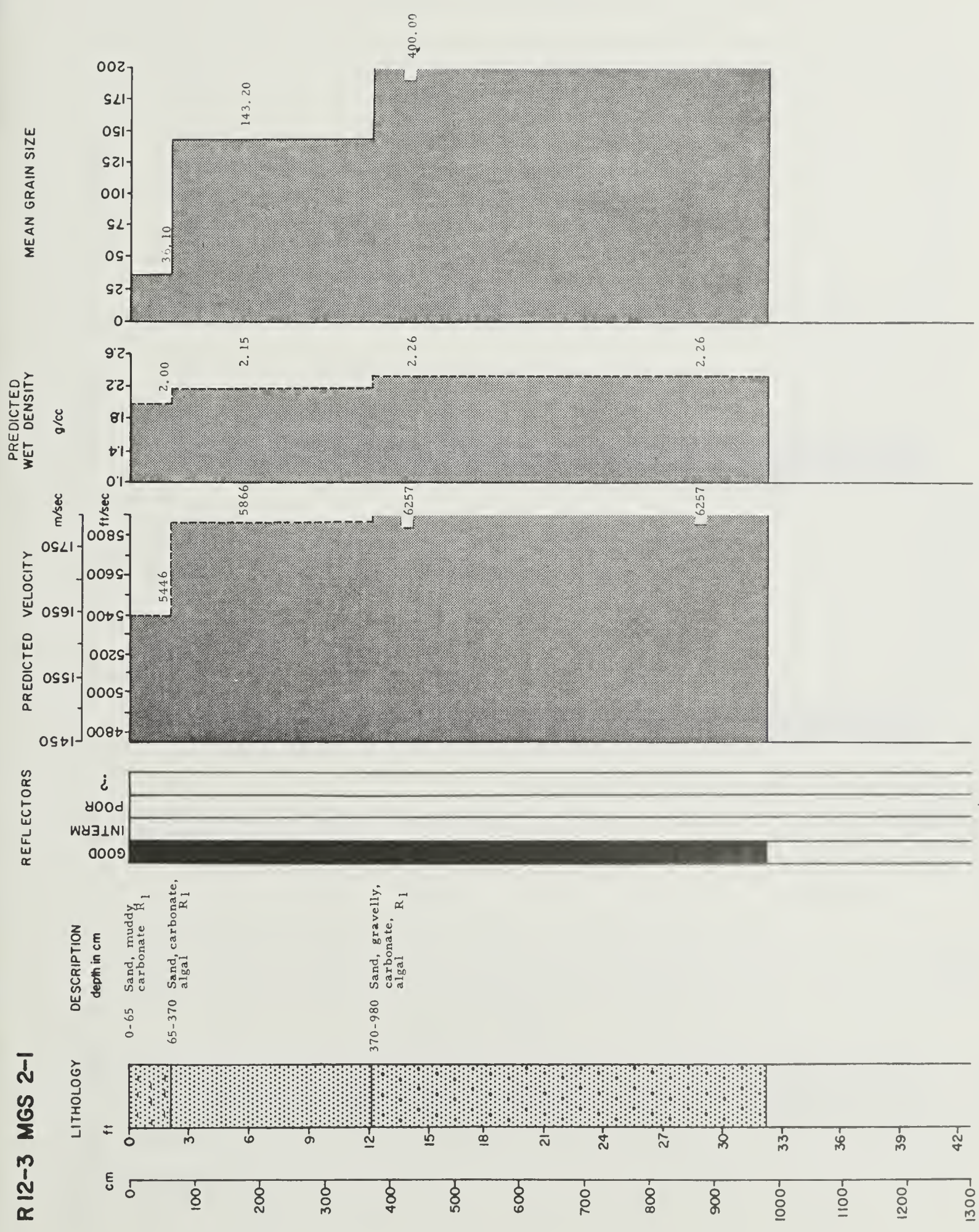
Reflectors: Solid black bars in columns give position and thickness of potential reflecting horizons. Reflectors are layers whose physical properties present high contrasts in acoustic impedance relative to the overlying seawater or sediments with which they are interstratified. The breakdown is qualitative: 1) good reflector -- >10 cm thick, 2) intermediate reflector -- 5 to 10 cm thick, 3) poor reflector -- <5 cm thick with well-defined upper and lower limits, and 4) questionable reflector -- <5 cm thick with poorly-defined limits.

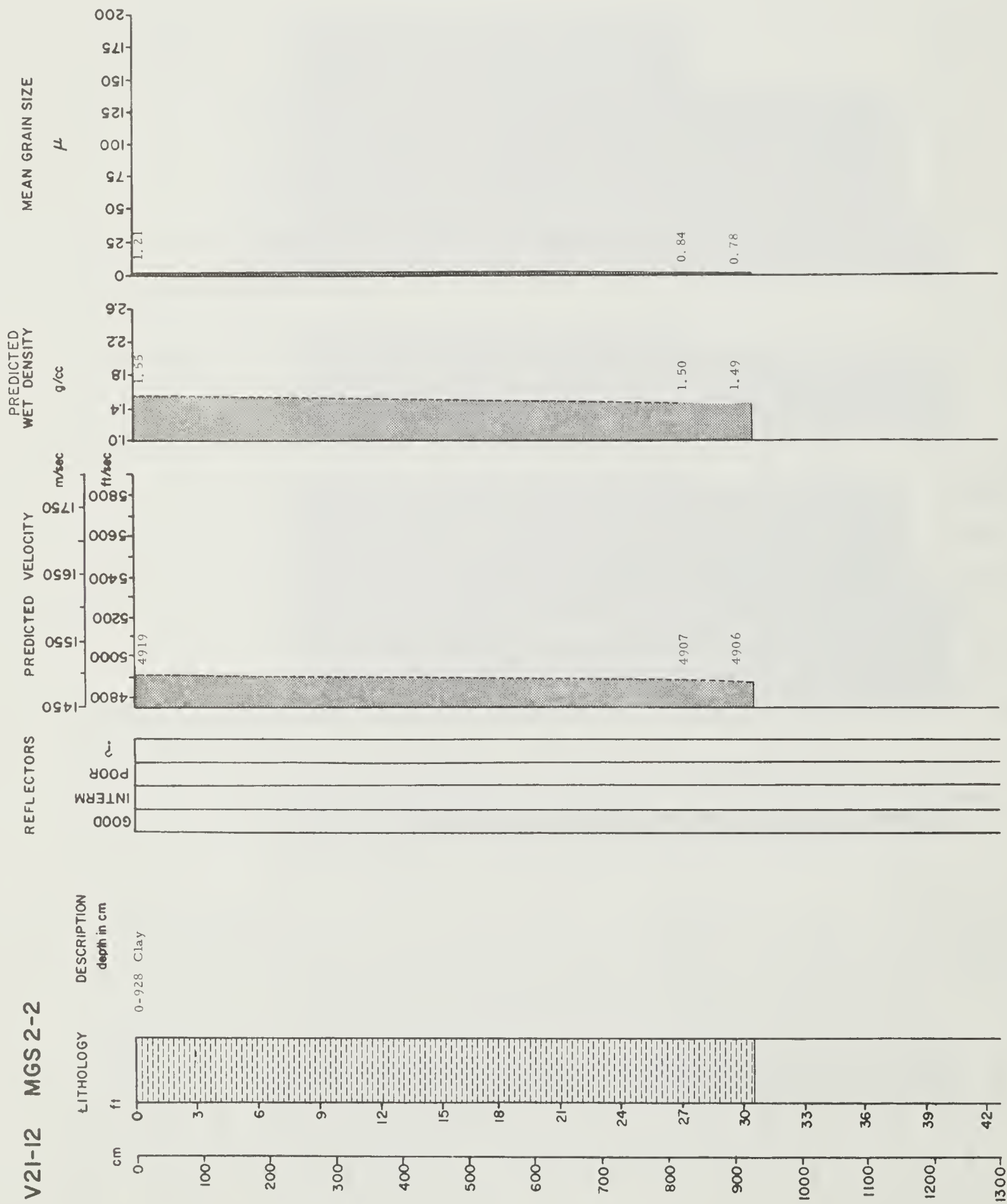
Predicted velocity: Dashed line outlining the velocity profile of core represents predictions taken from table given in Appendix C. Velocities are adjusted to 23°C at 1 atmosphere pressure. They must be corrected to in situ conditions prior to use in the field. Prediction of sound velocity is based on mean grain size of sediment.

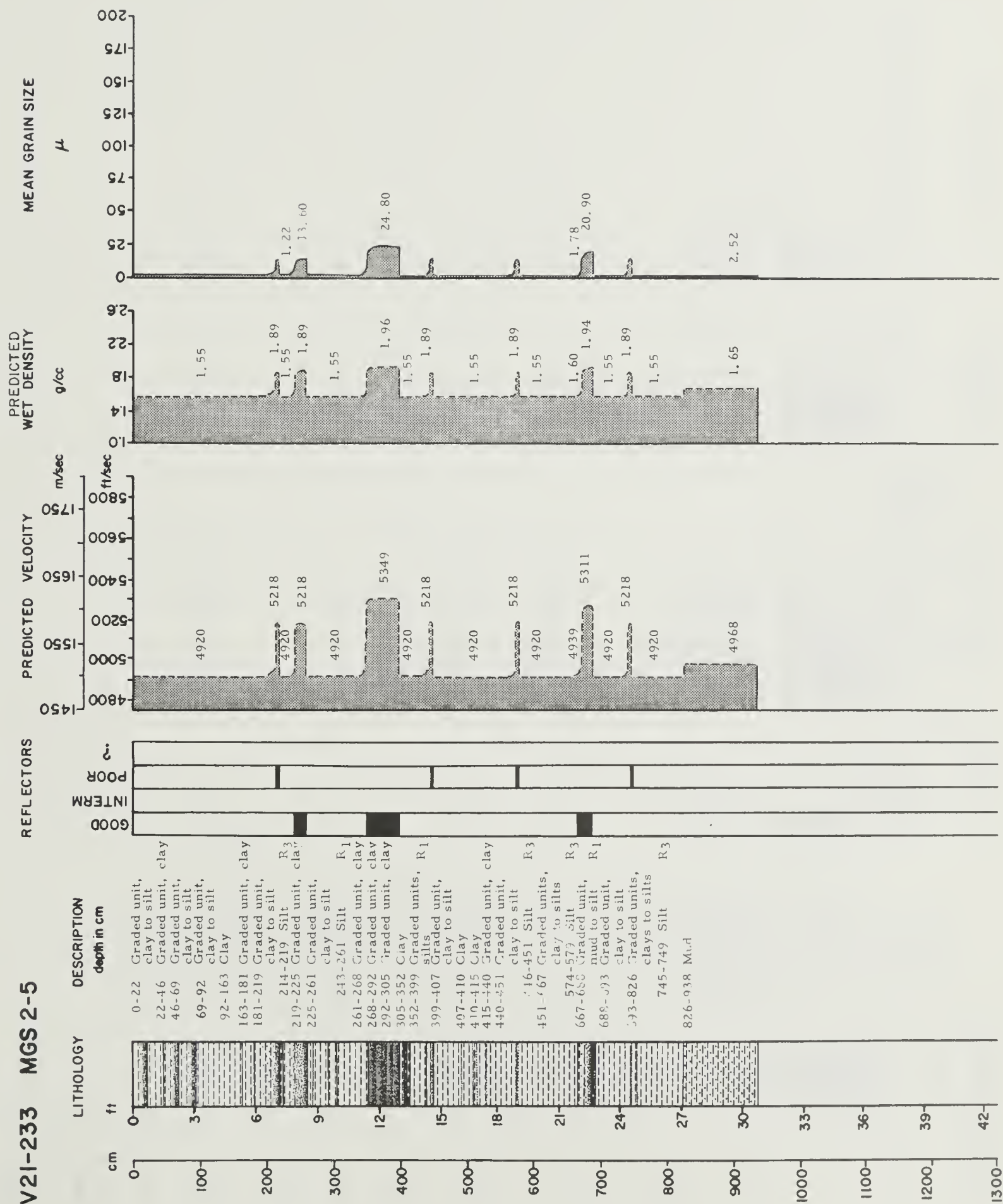
Wet density: The profile of wet density is a prediction using mean grain size as an index to physical properties of the cores. These predictions are arrived at indirectly and should be used with this understanding.

Mean grain size: Solid line on textural profile of core indicates actual laboratory measurement. Dashed line includes sections of core where direct measurement was not made, but data were determined from representative samples of similar layers comprising core.

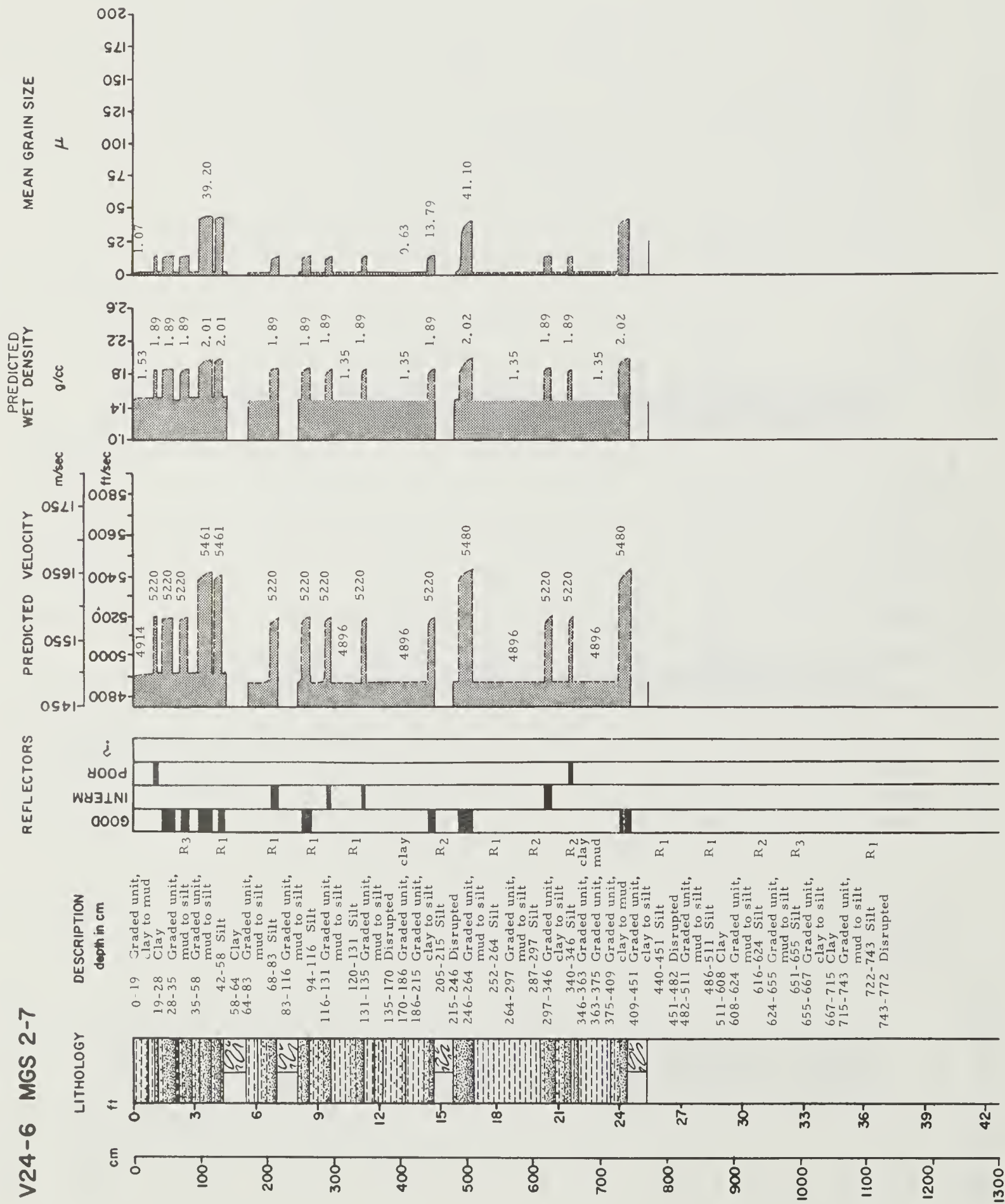
R12-3 MGS 2-1



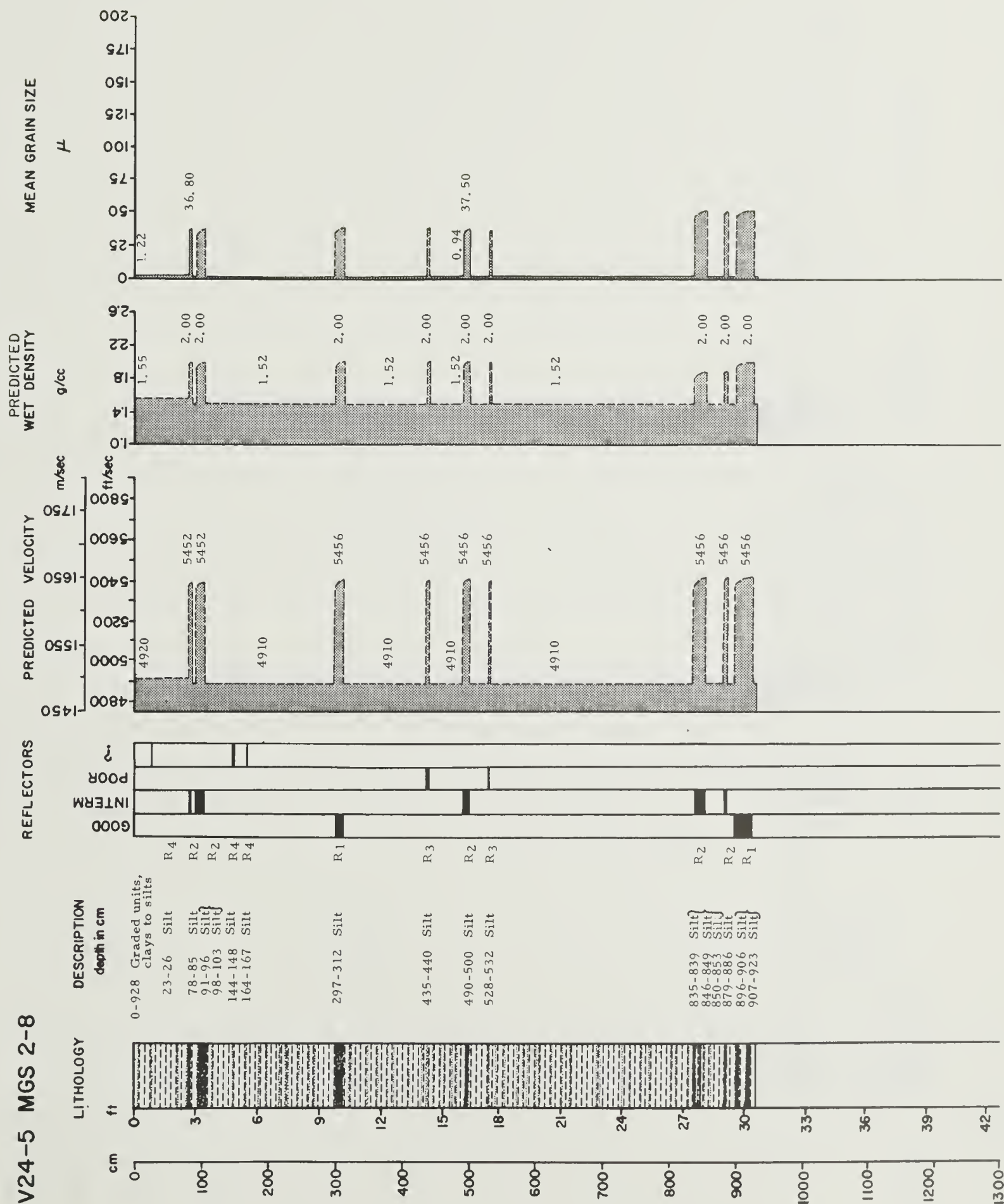




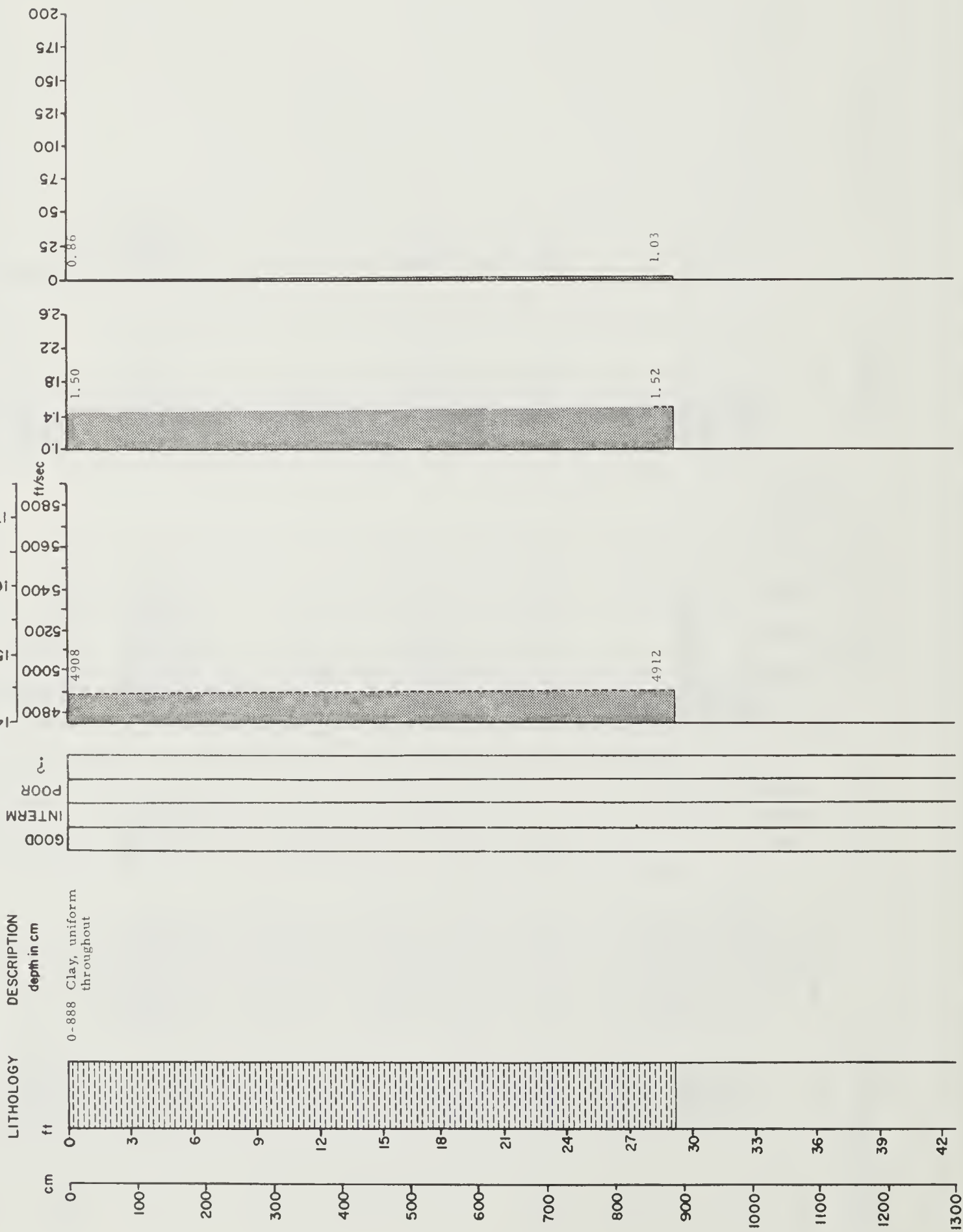
V24-6 MGS 2-7



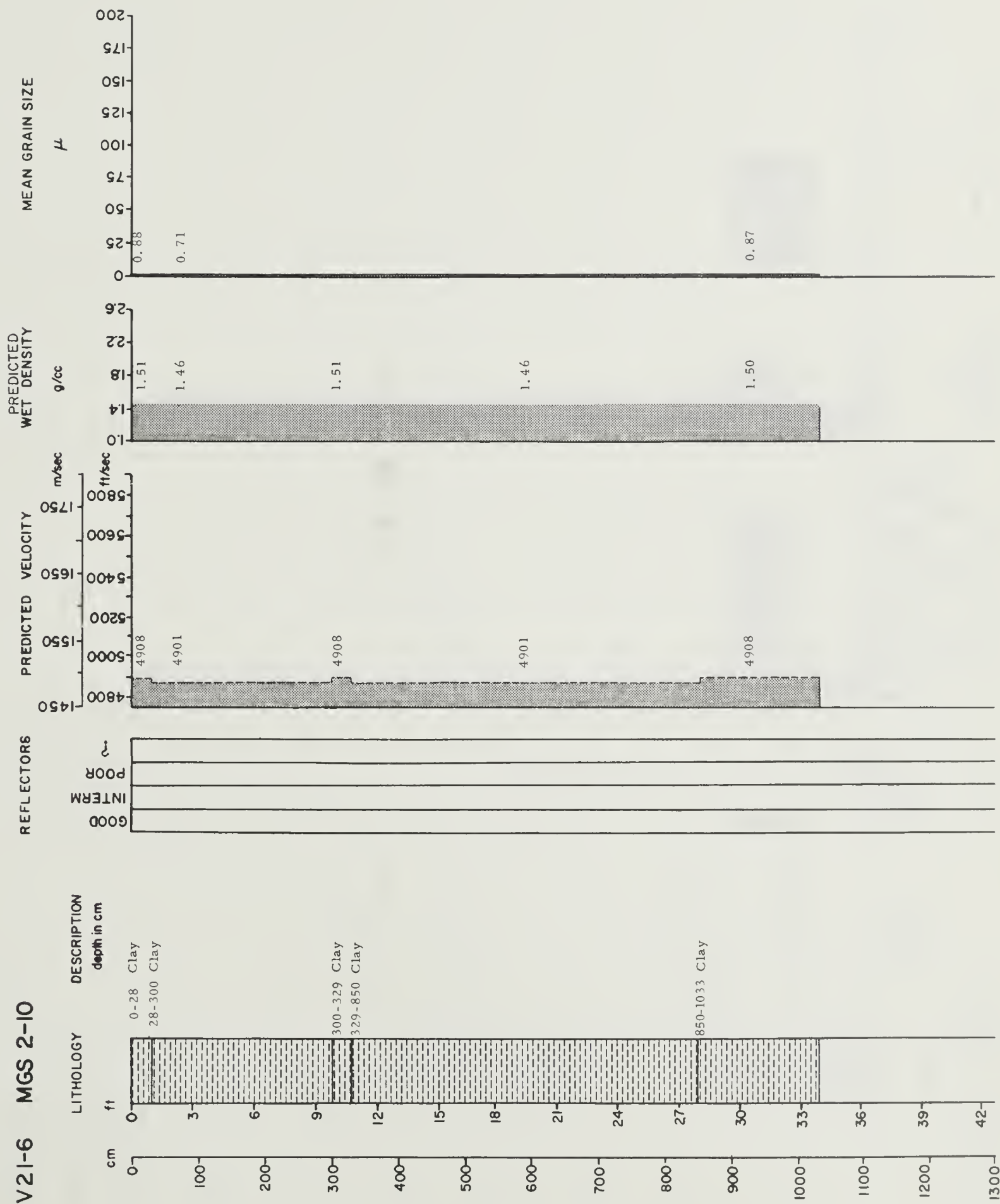
V24-5 MGS 2-8



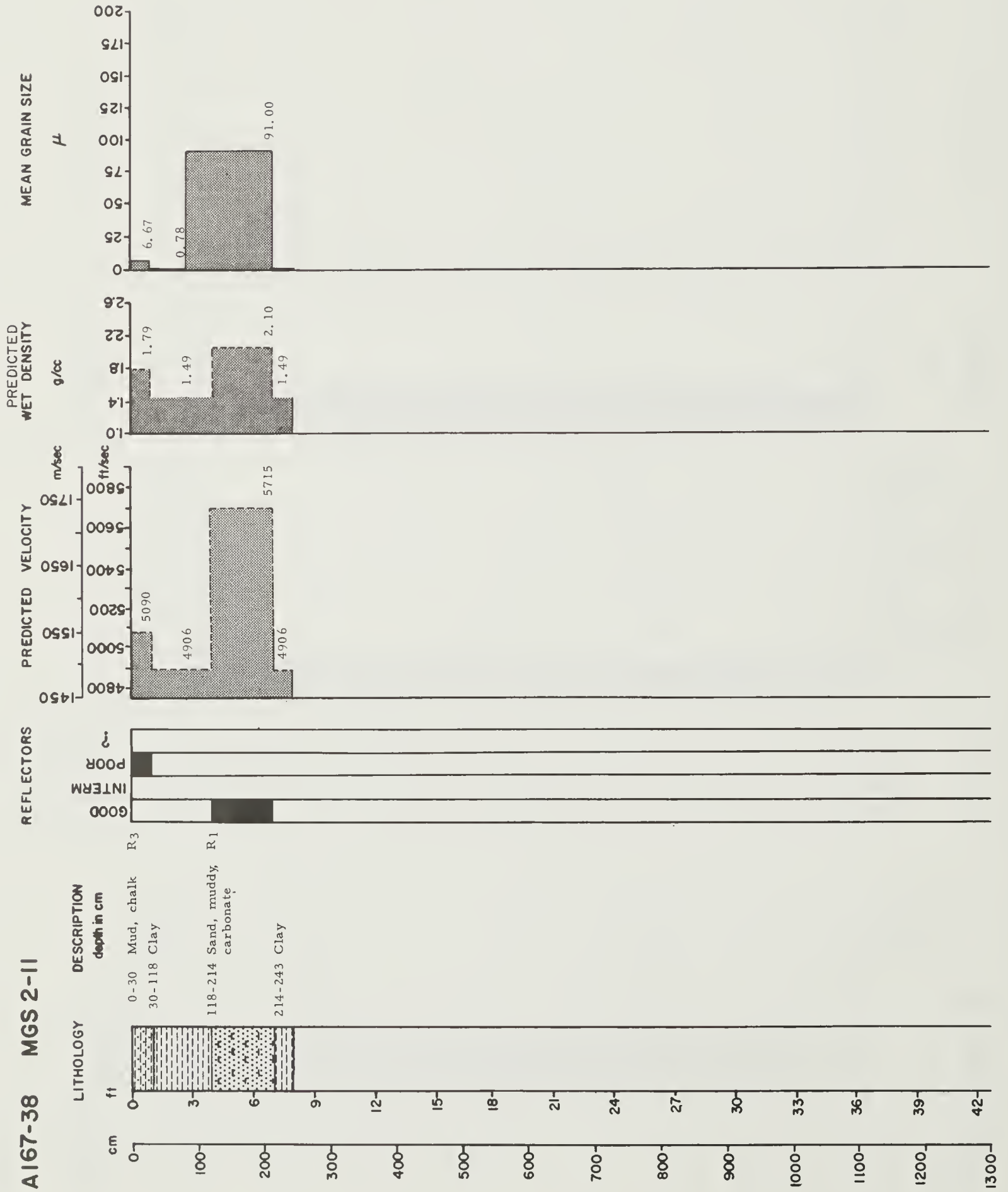
RC 4-2 MGS 2-9
MGS 2-16



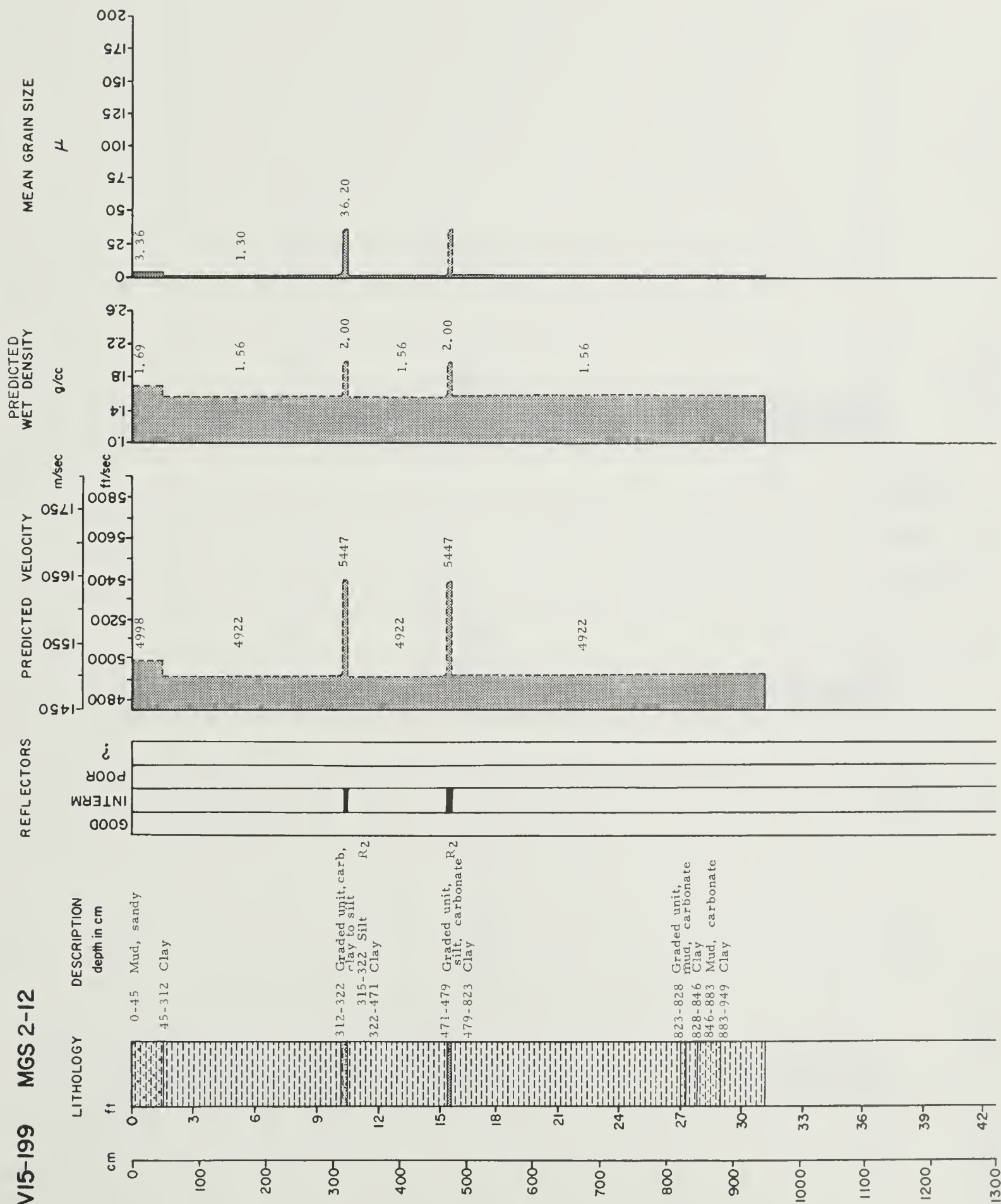
V21-6 MGS 2-10



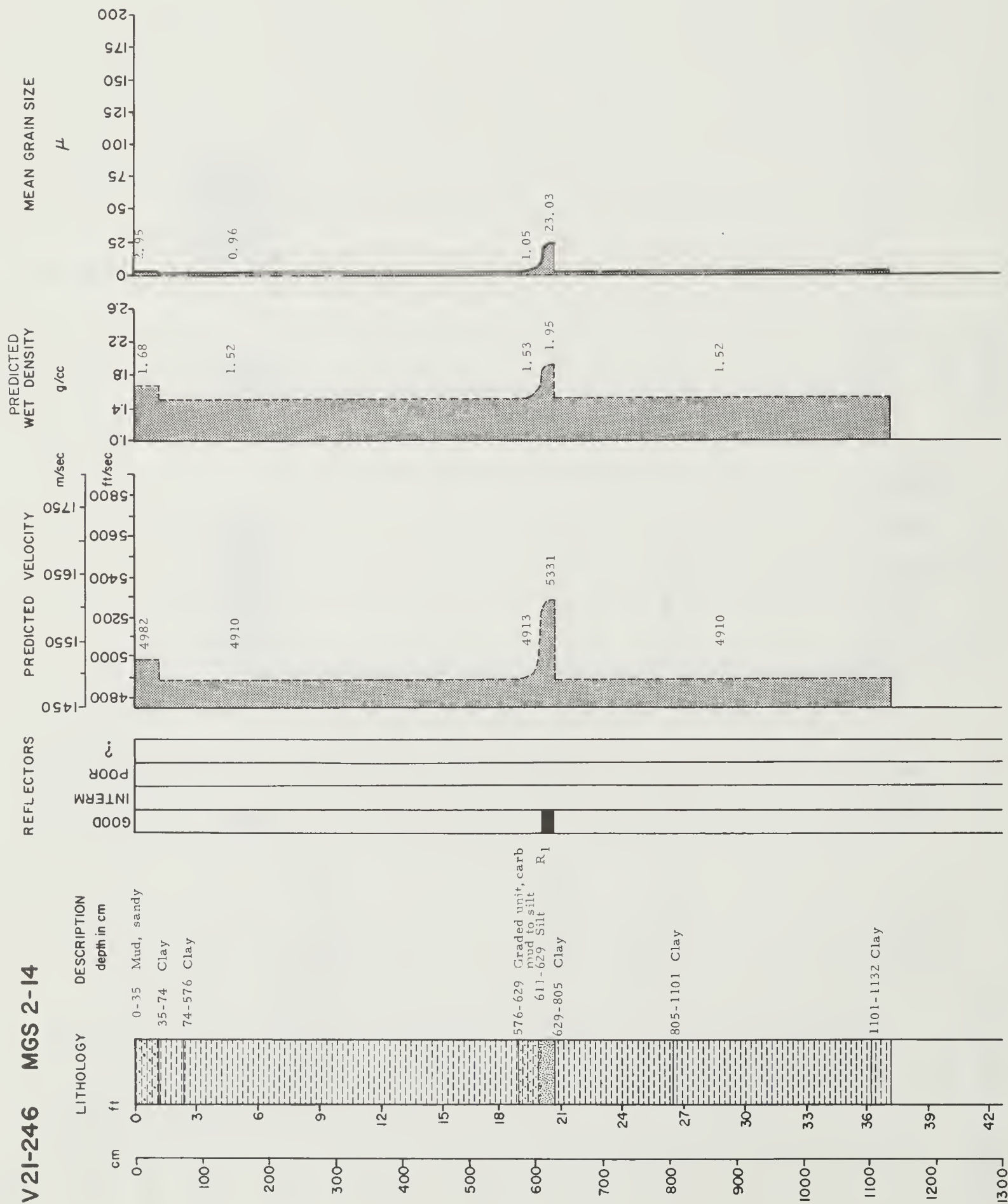
A167-38 MGS 2-II



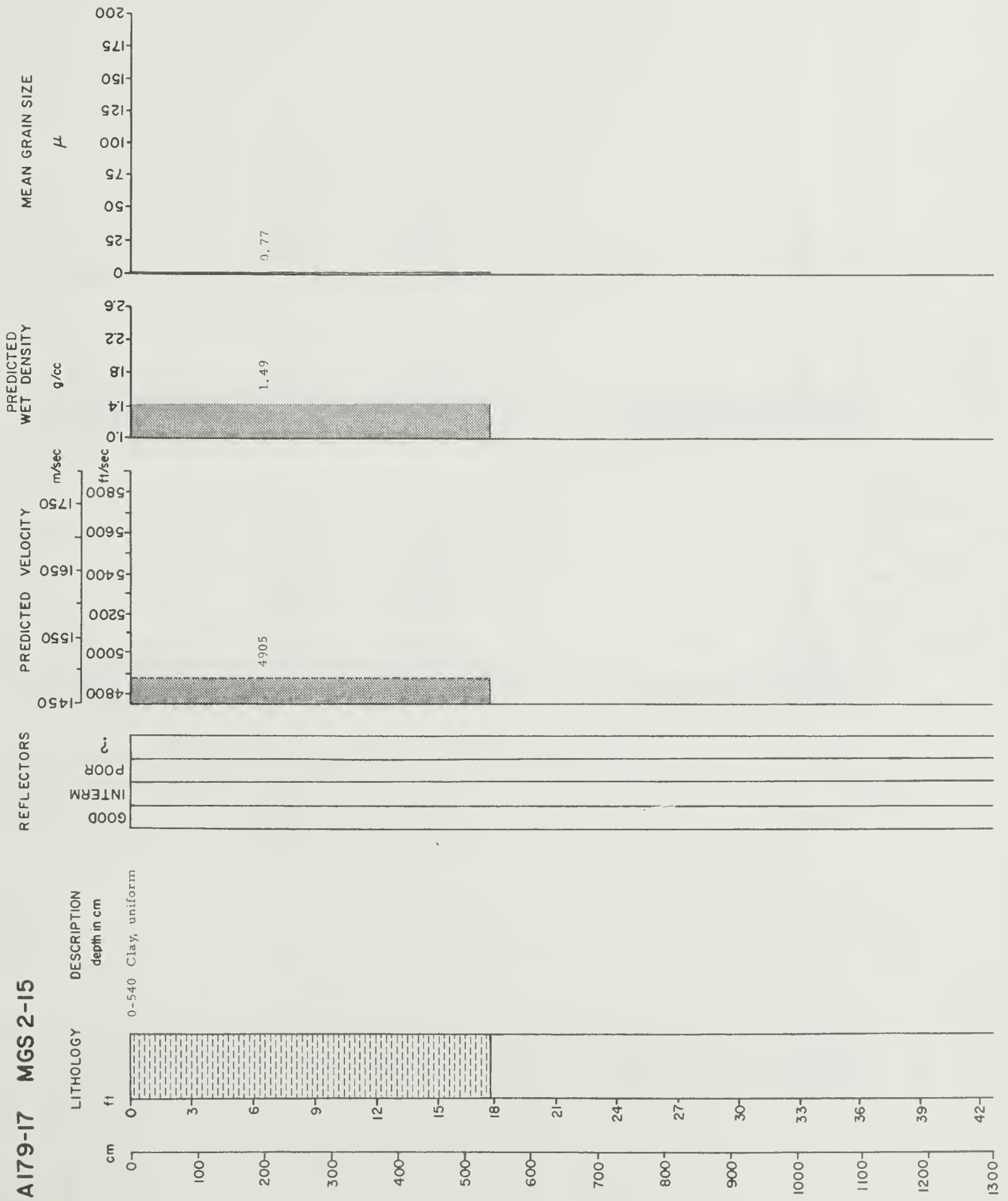
VI5-199 MGS 2-12



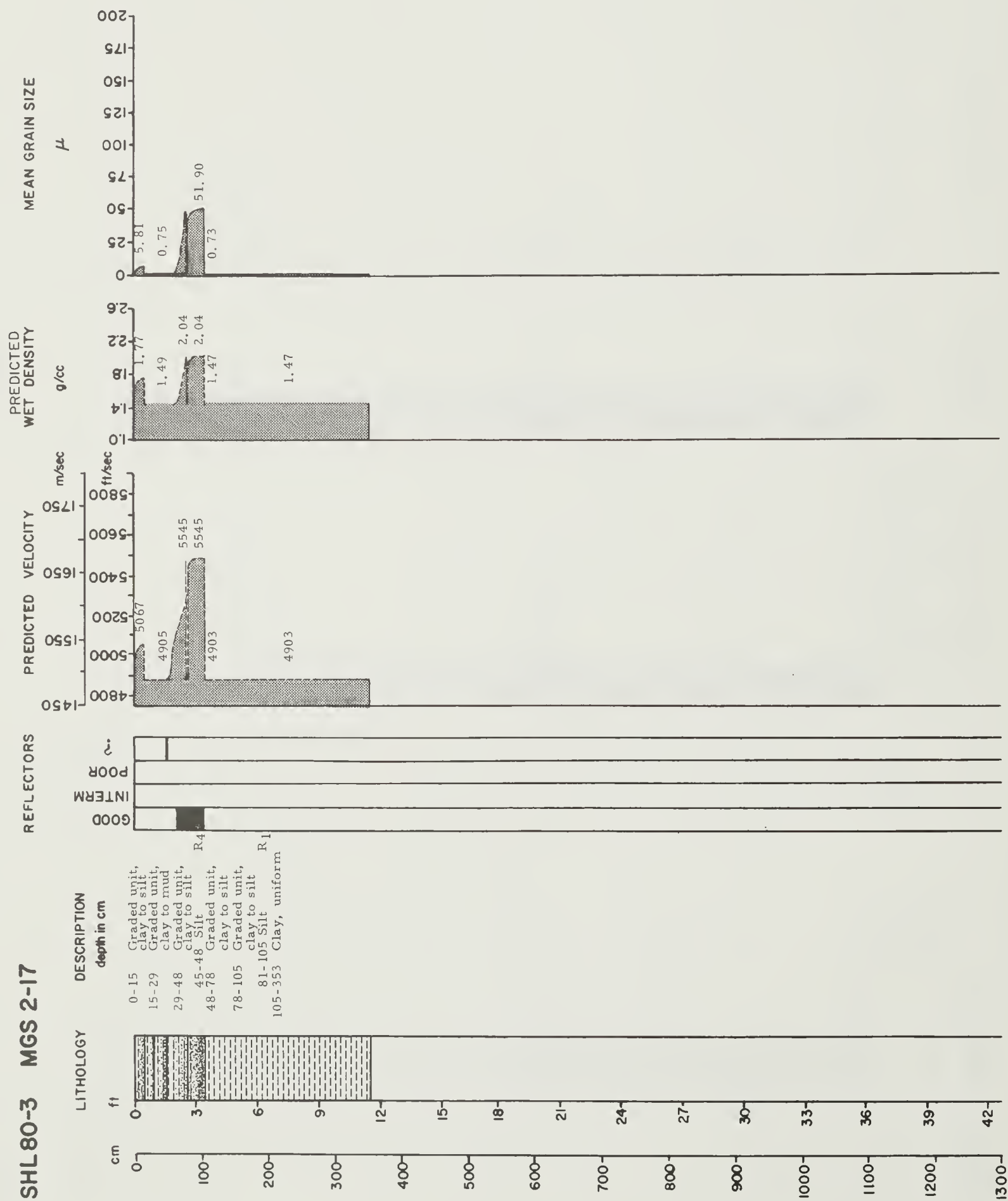
V21-246 MGS 2-14



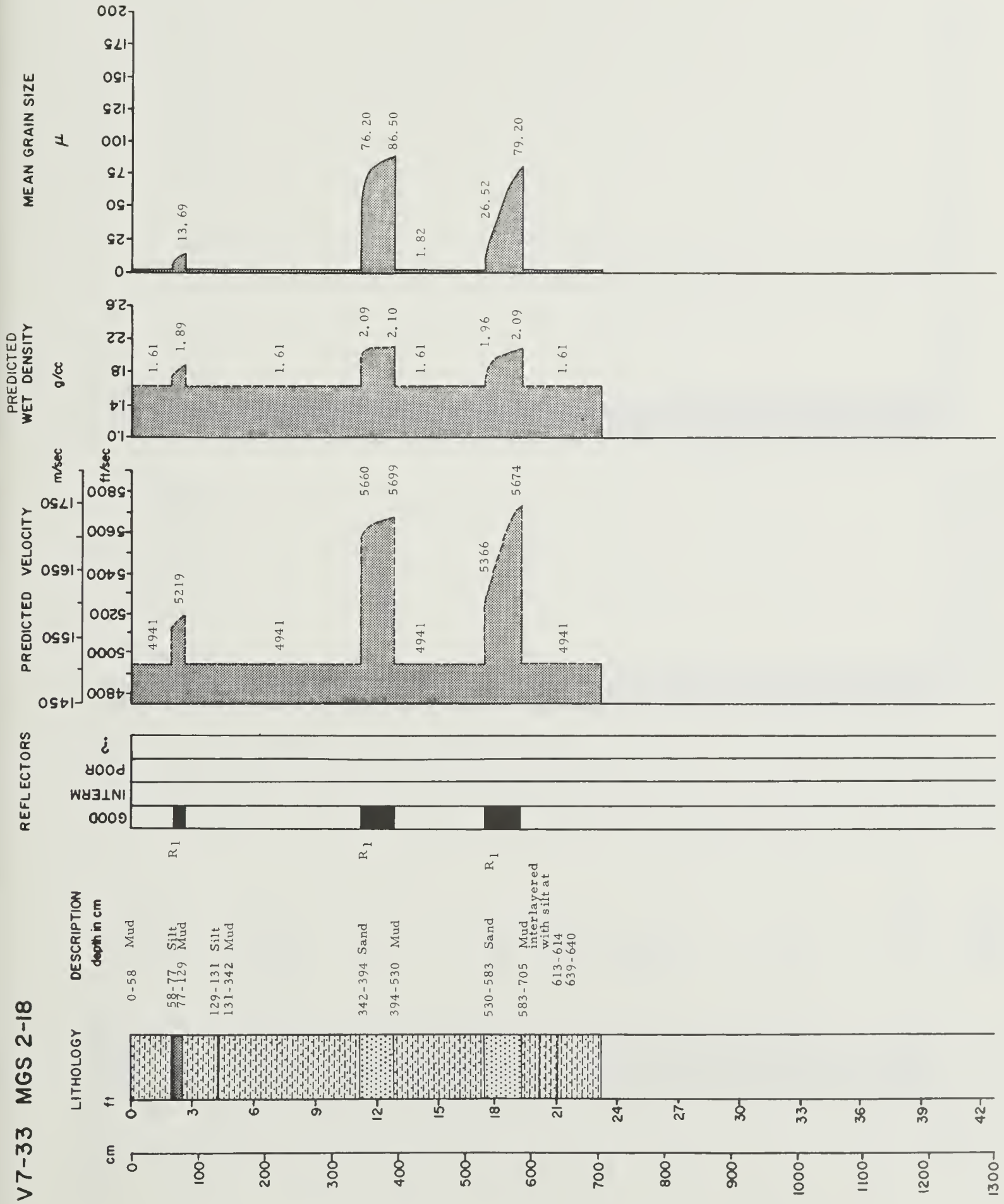
A179-17 MGS 2-15



SHL80-3 MGS 2-17



V7-33 MGS 2-18



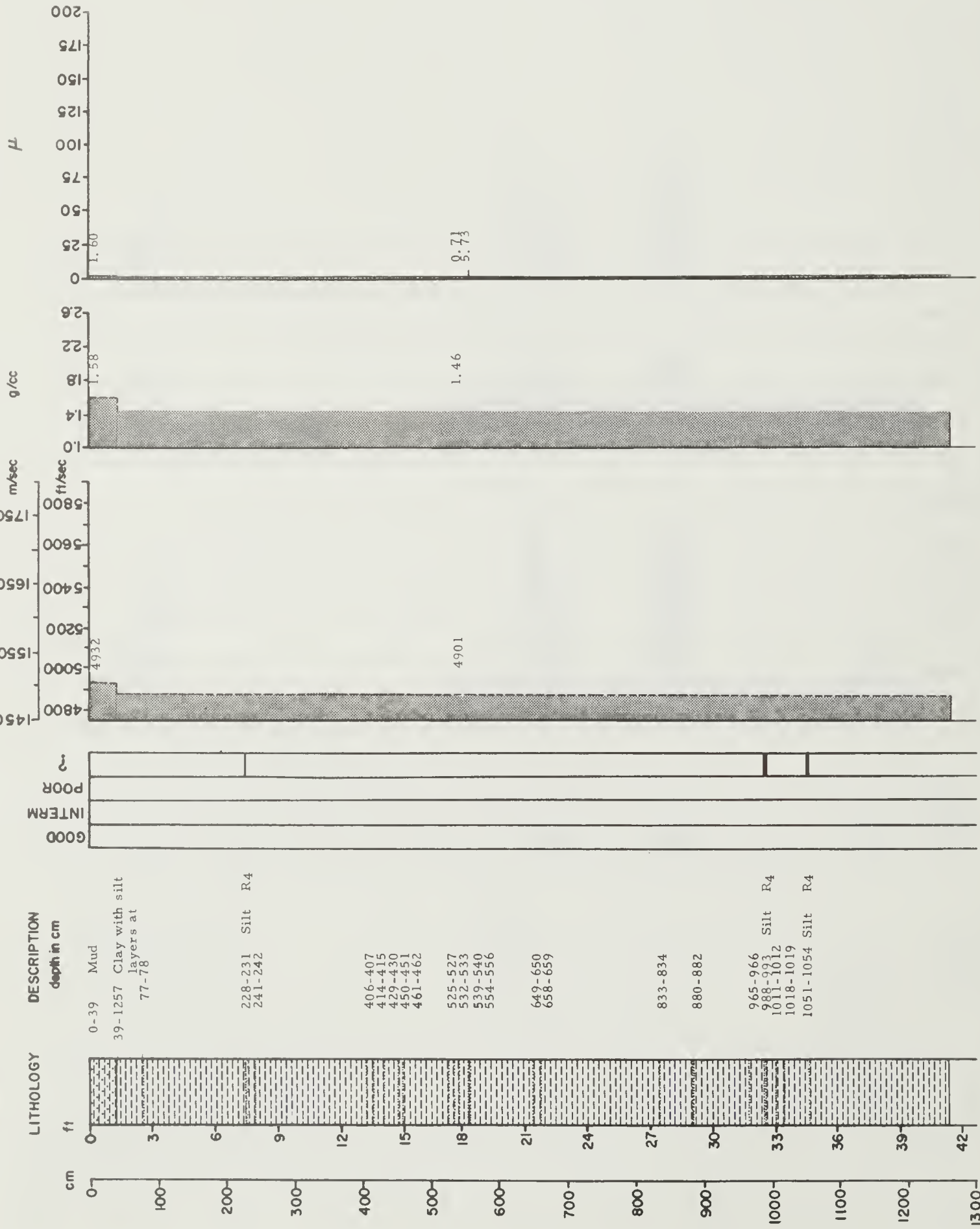
RC 9-II MGS 2-19

REFLECTORS

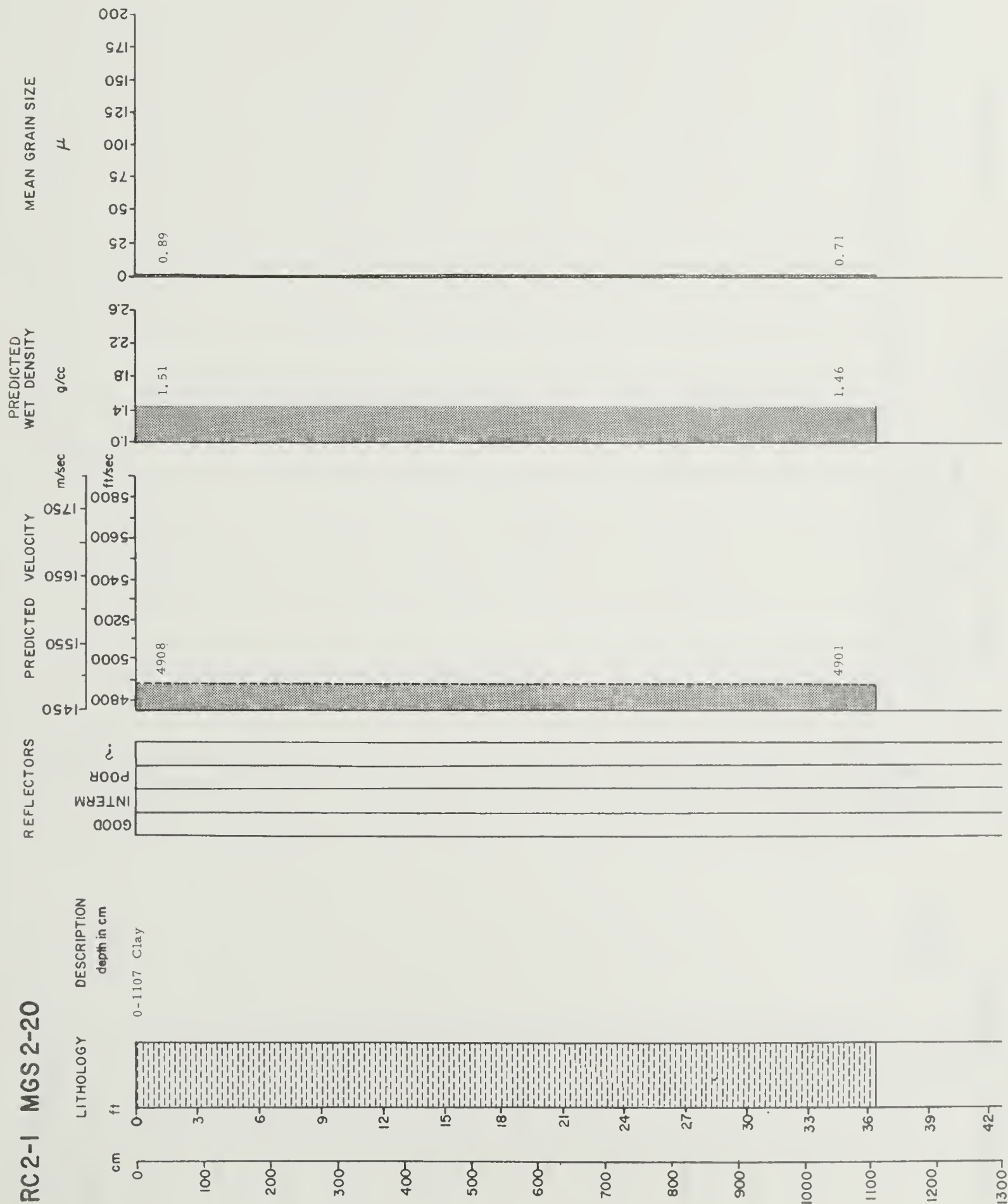
PREDICTED VELOCITY

PREDICTED WET DENSITY

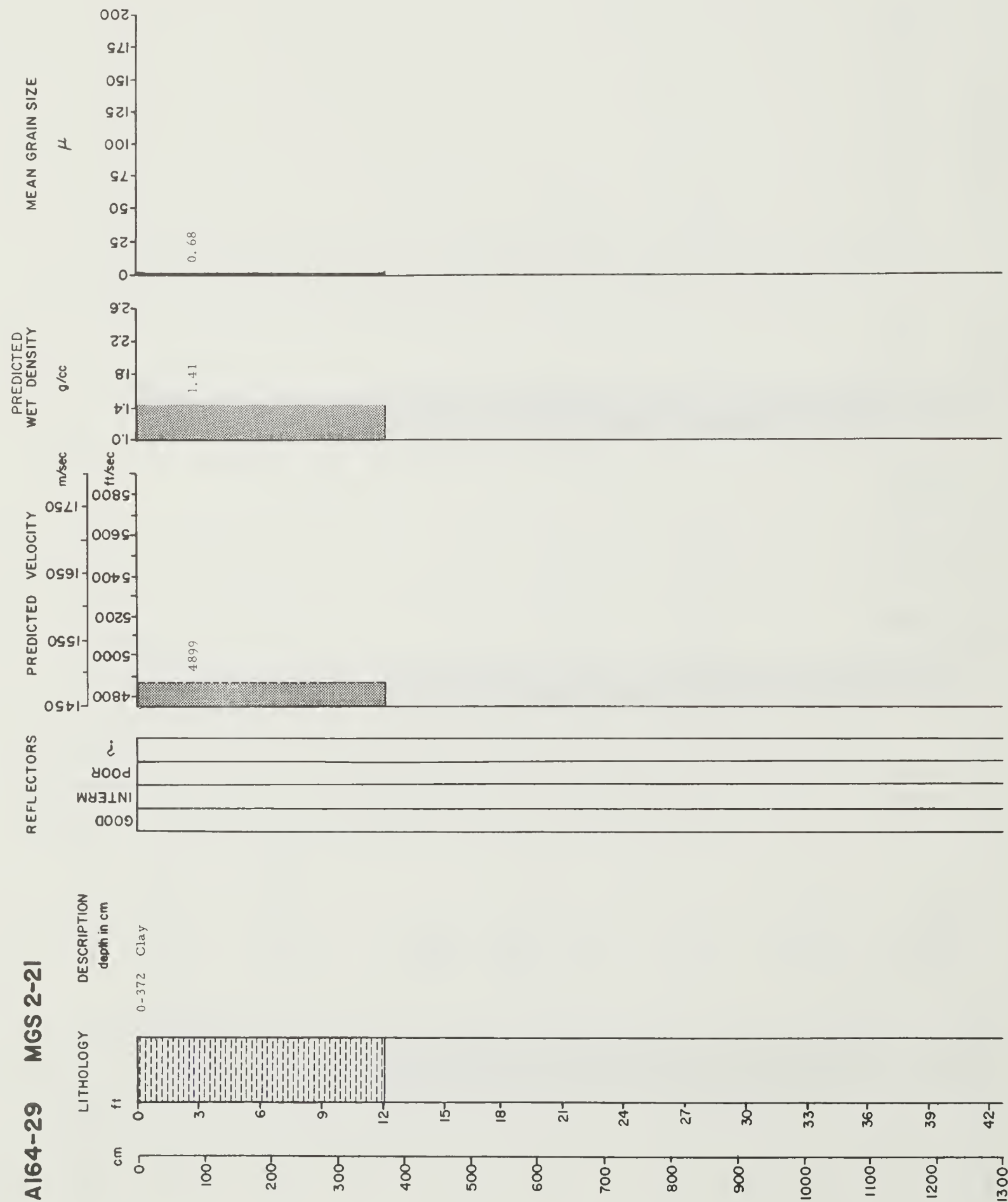
MEAN GRAIN SIZE

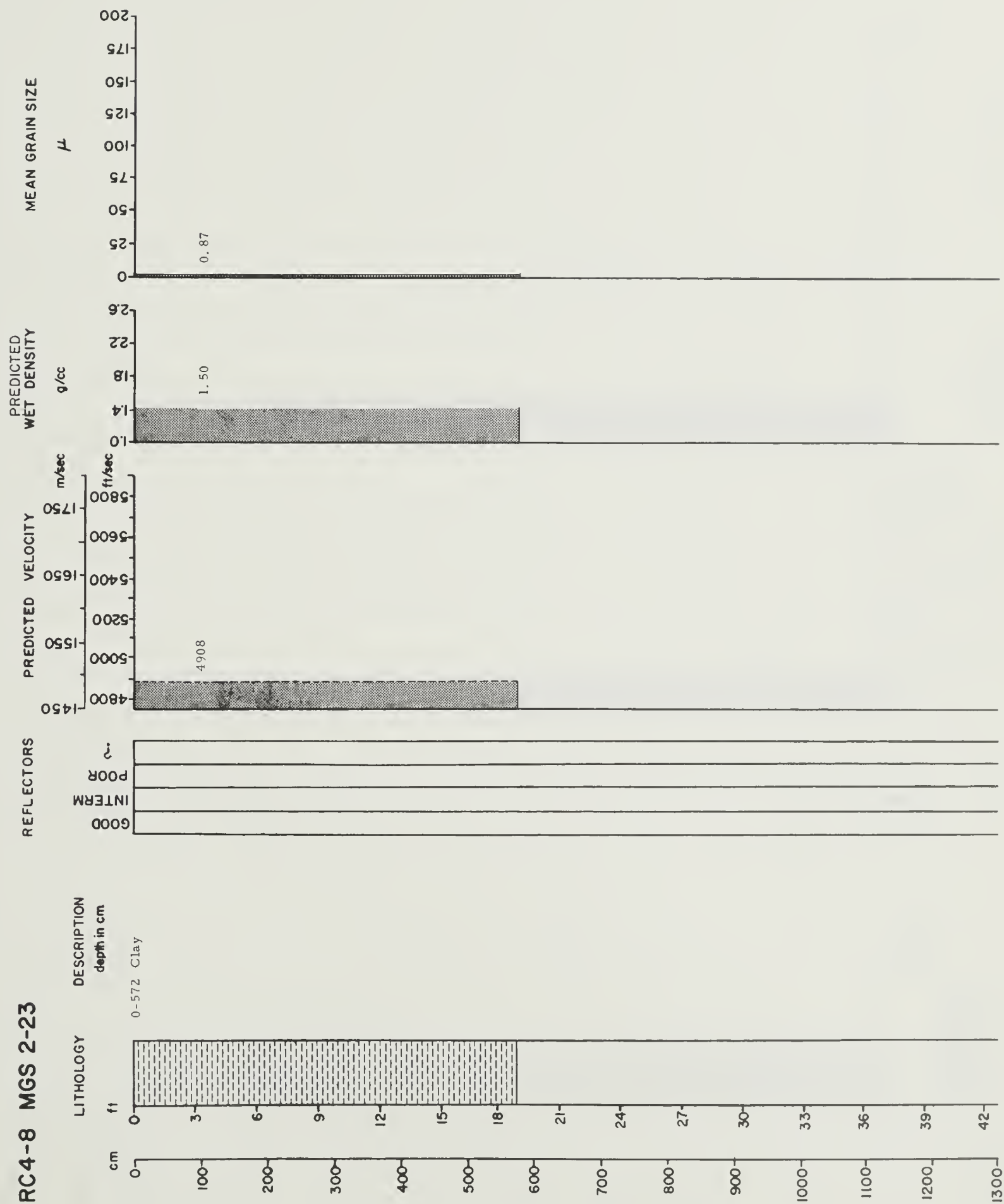


RC2-1 MGS 2-20



AI64-29 MGS 2-21

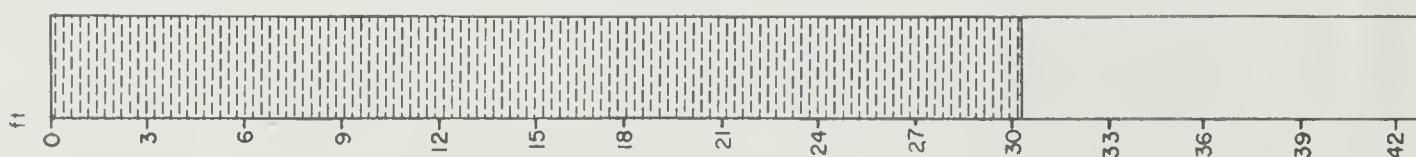




R12-7
MGS 2-24
MGS 2-28

LITHOLOGY DESCRIPTION
depth in cm

0-920 Clay



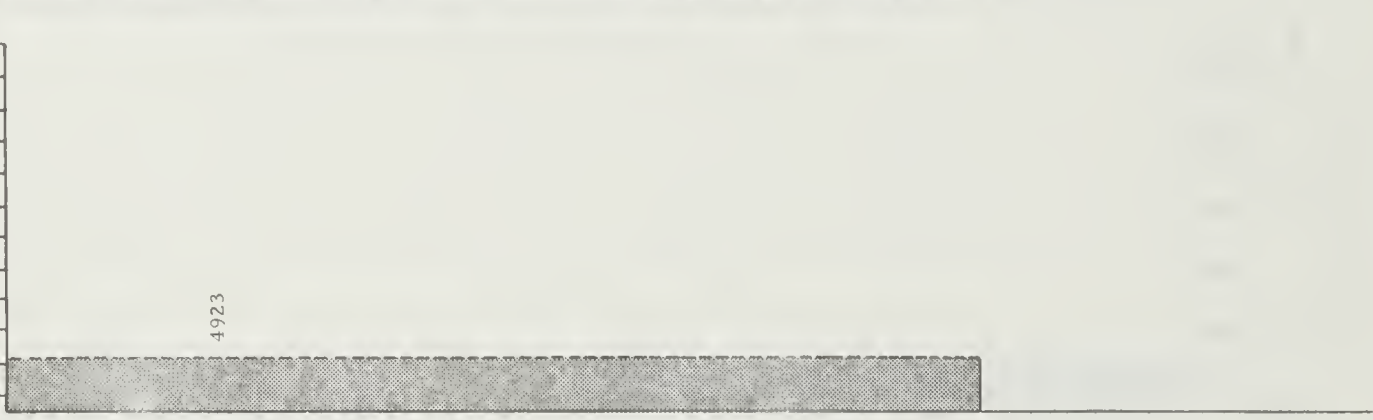
REFLECTORS

GOOD
INTERM
POOR
?

PREDICTED VELOCITY

m/sec
ft/sec

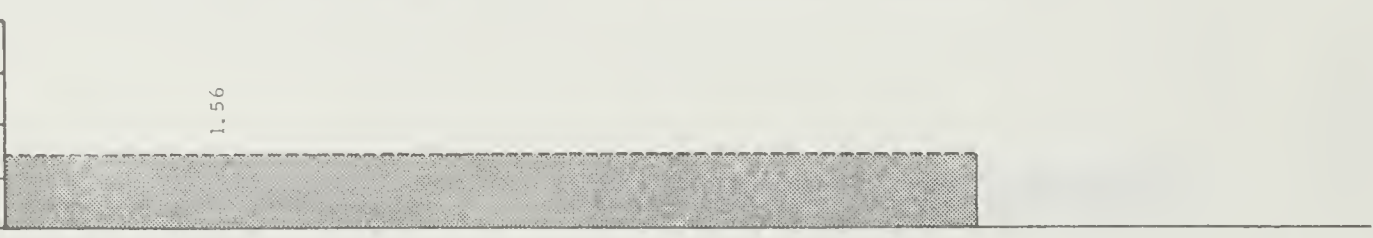
1450
1500
1550
1650
1750
1800



PREDICTED WET DENSITY

g/cc

1.0
1.4
1.8
2.2
2.6



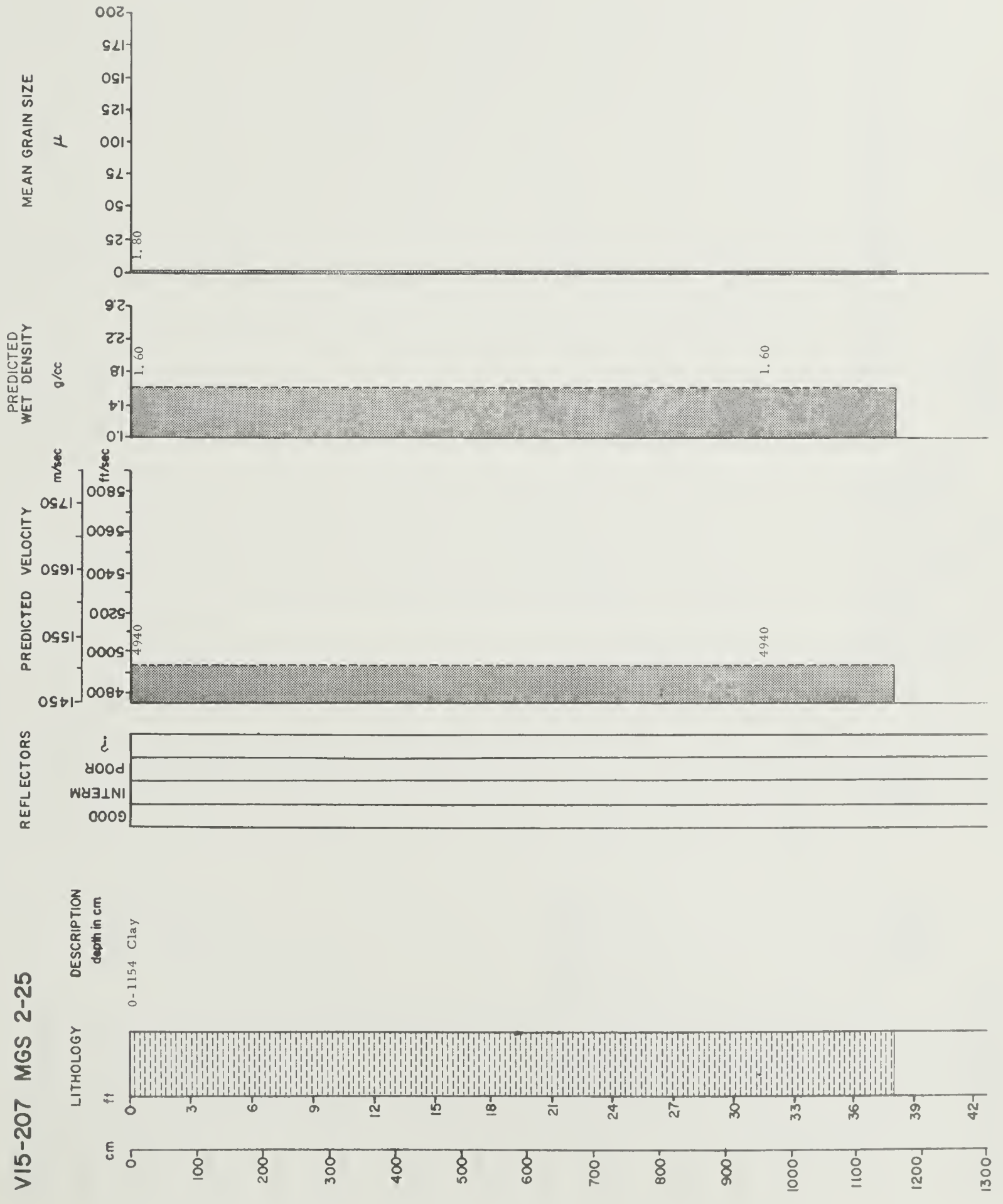
MEAN GRAIN SIZE

μ

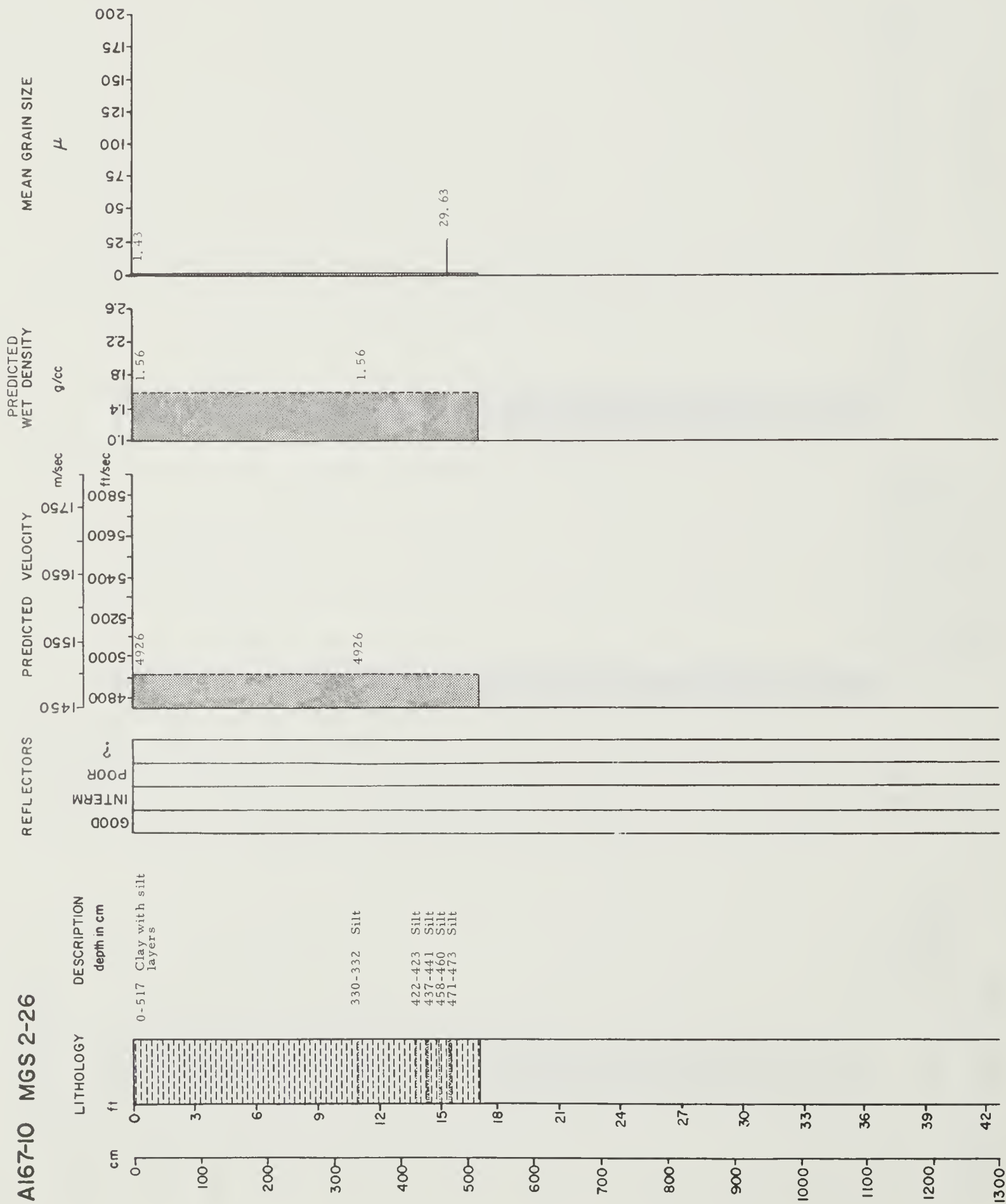
0
25
50
75
100
125
150
175
200



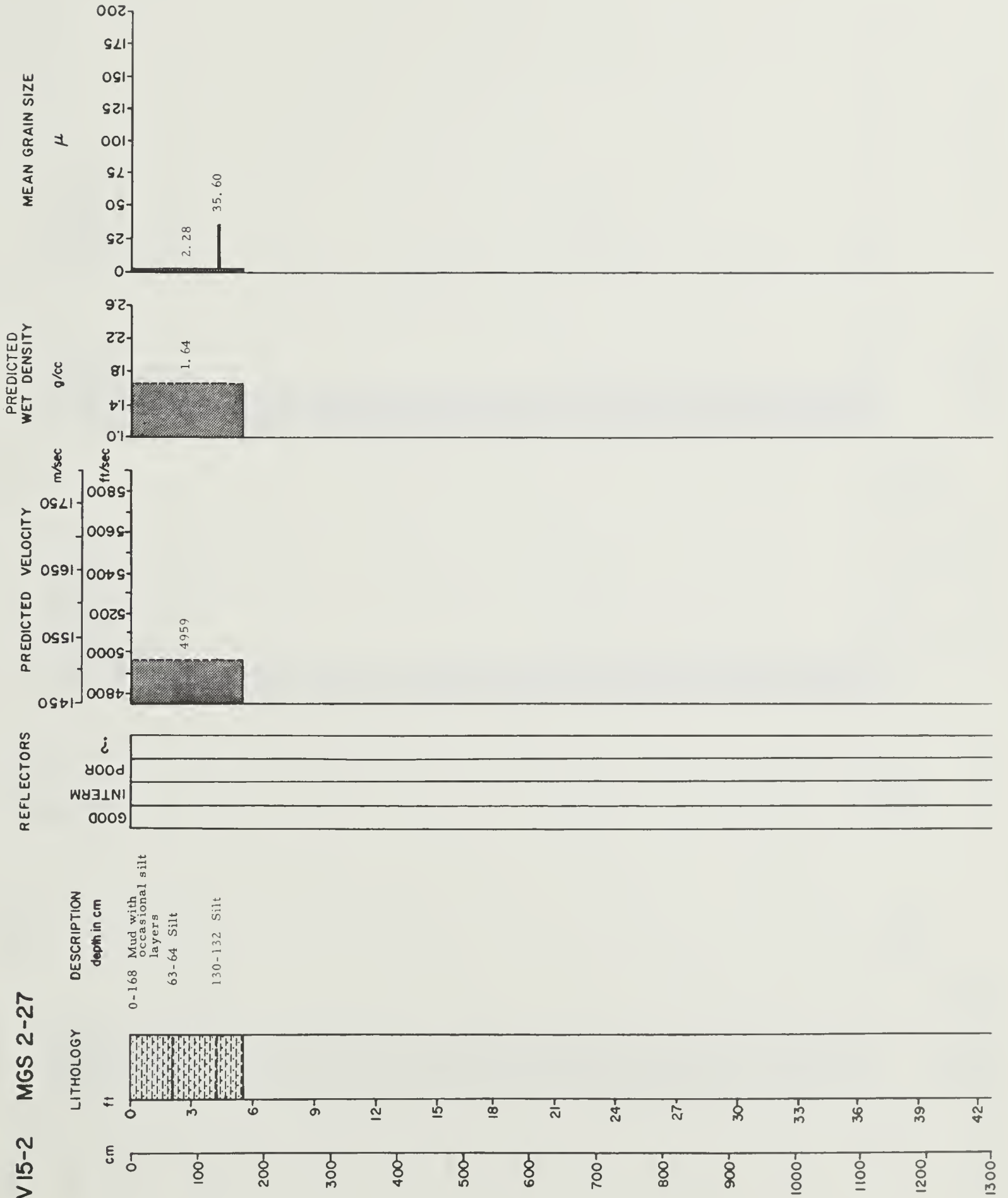
VI5-207 MGS 2-25

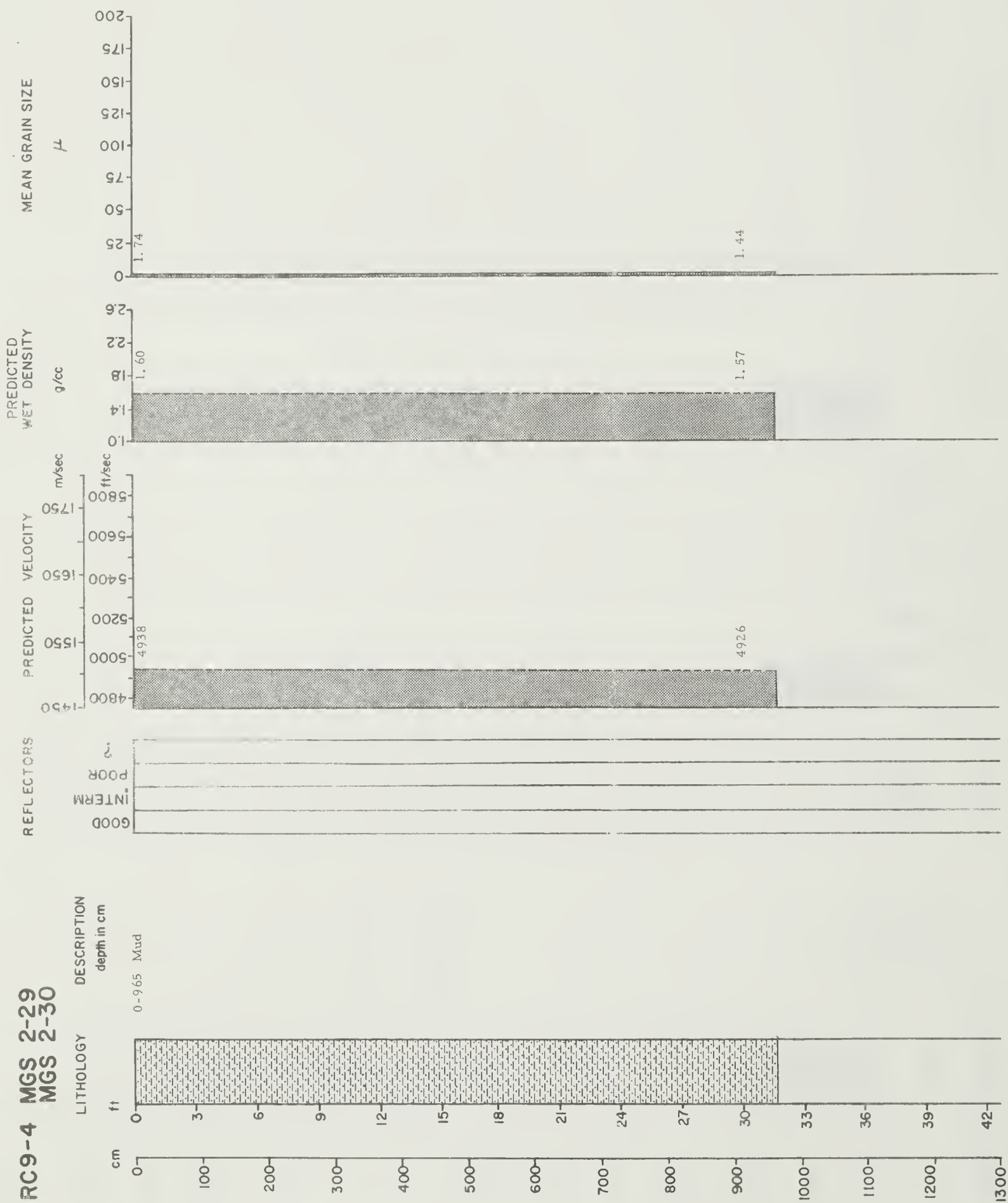


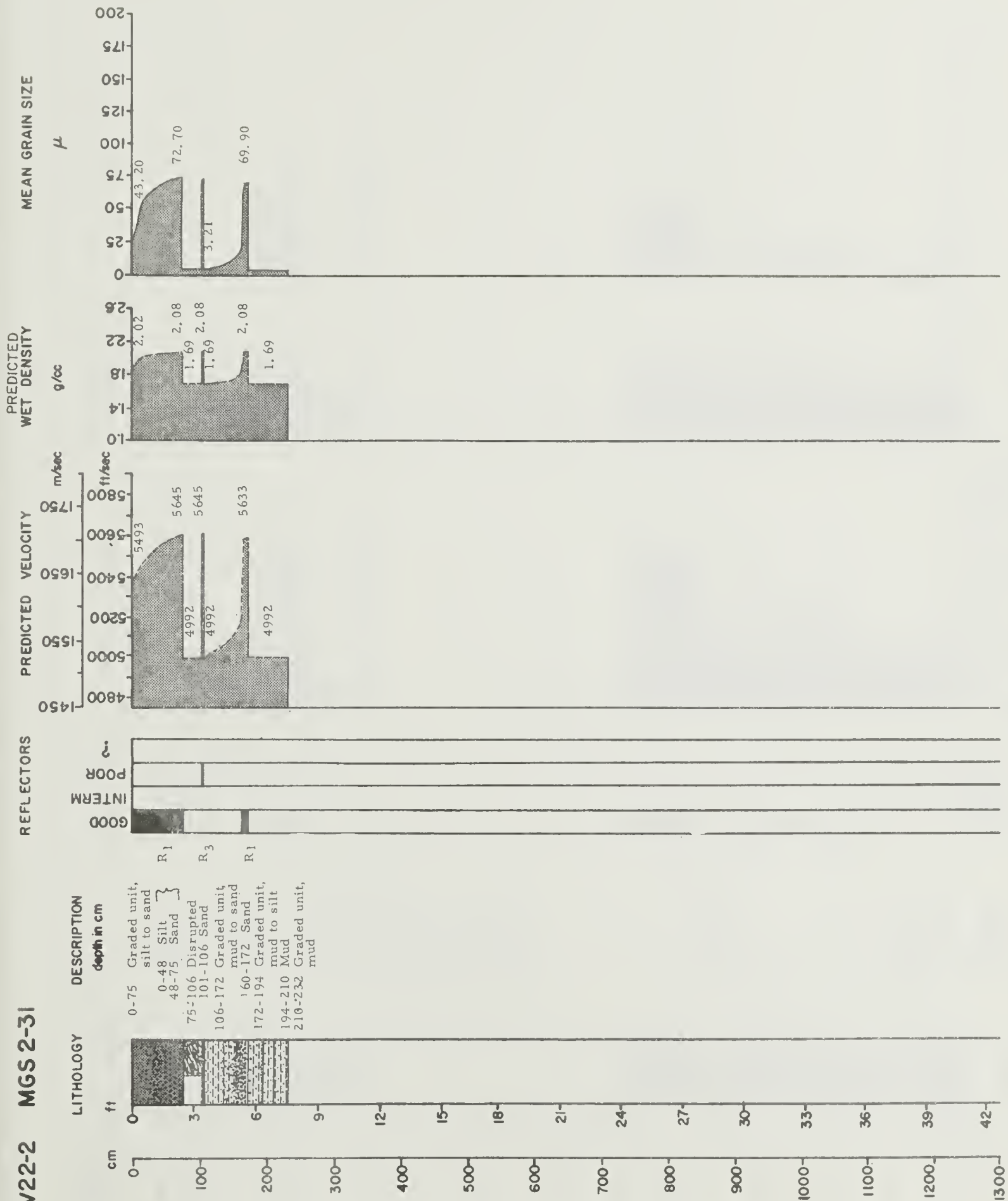
A167-10 MGS 2-26



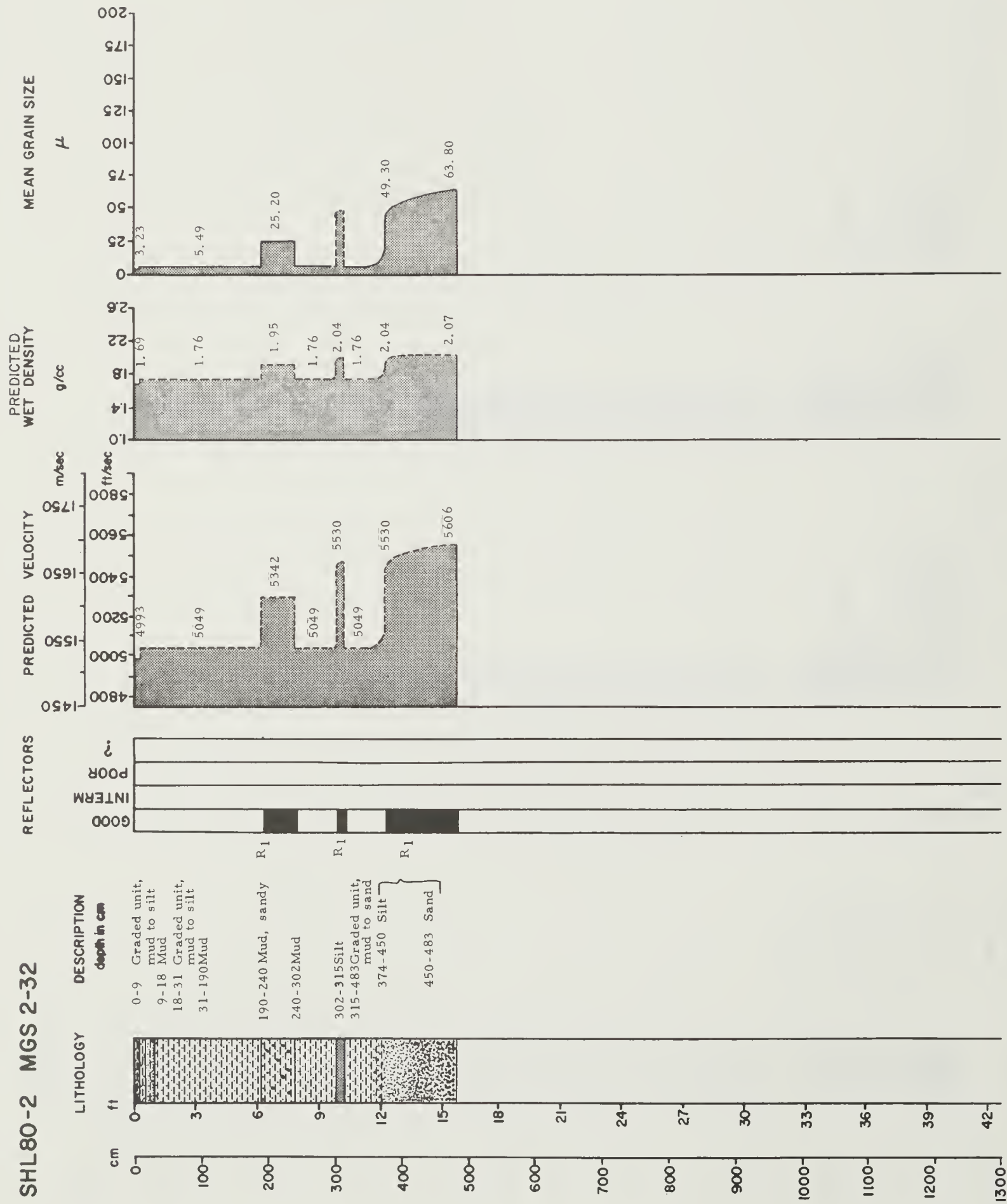
V15-2 MGS 2-27



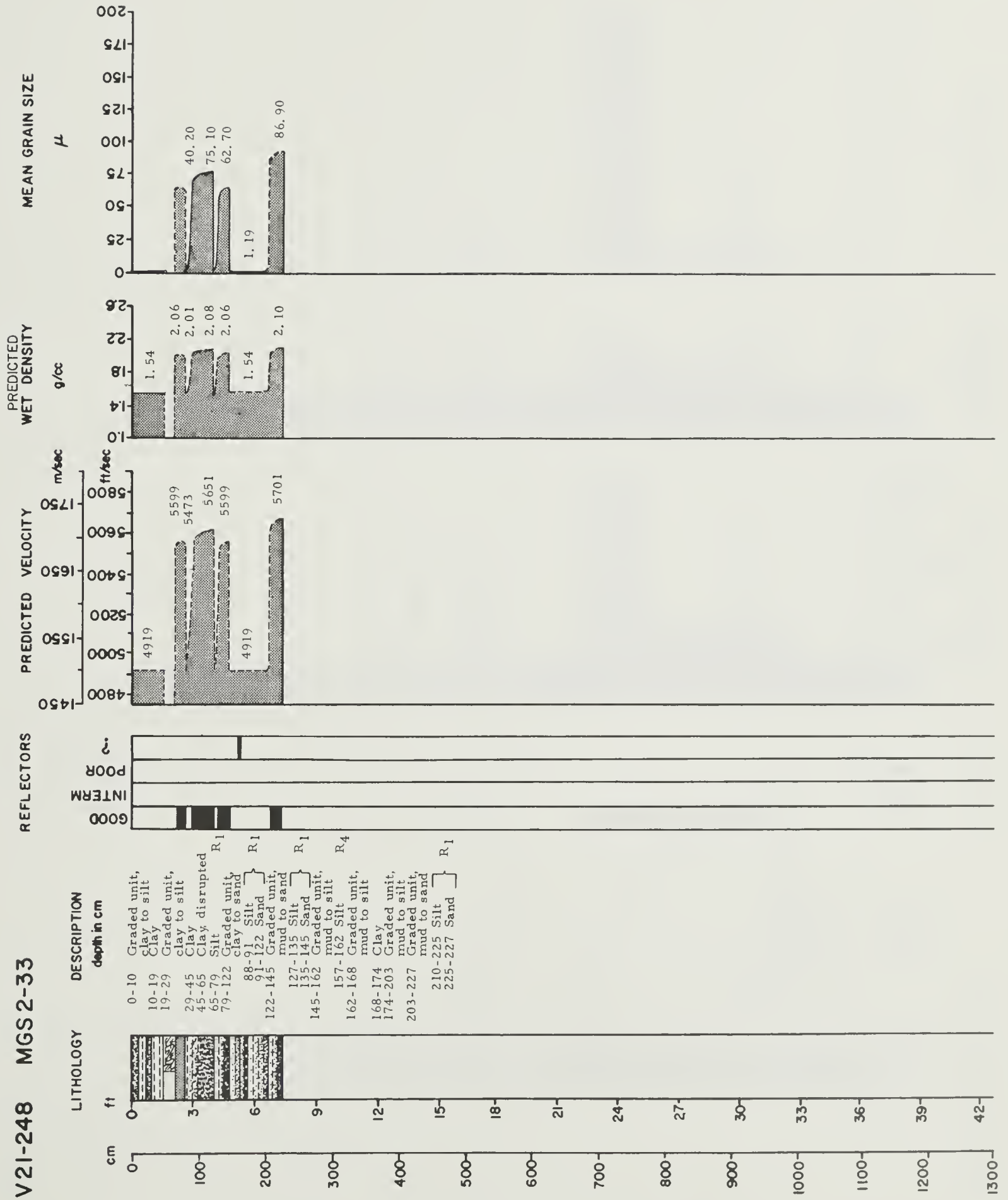


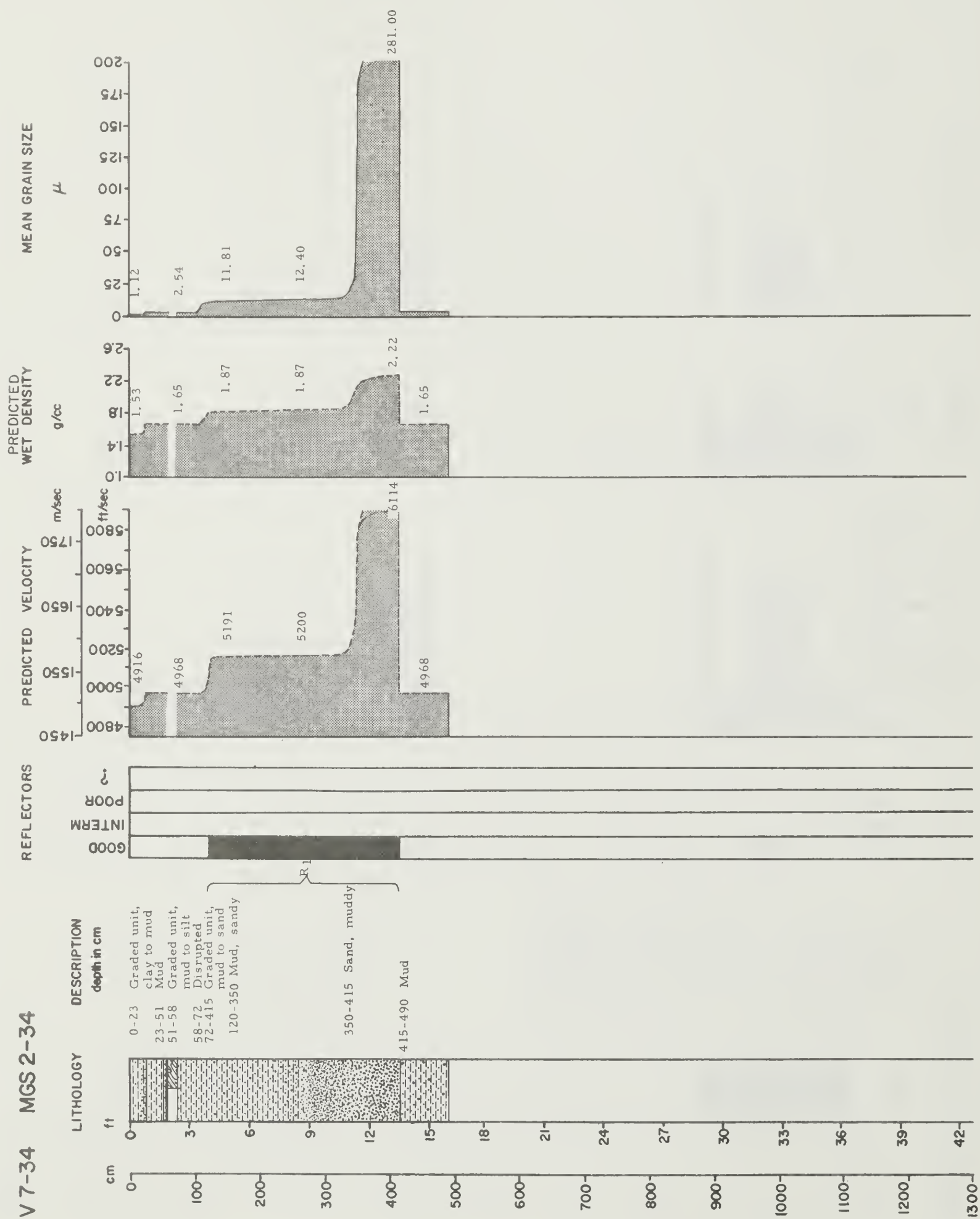


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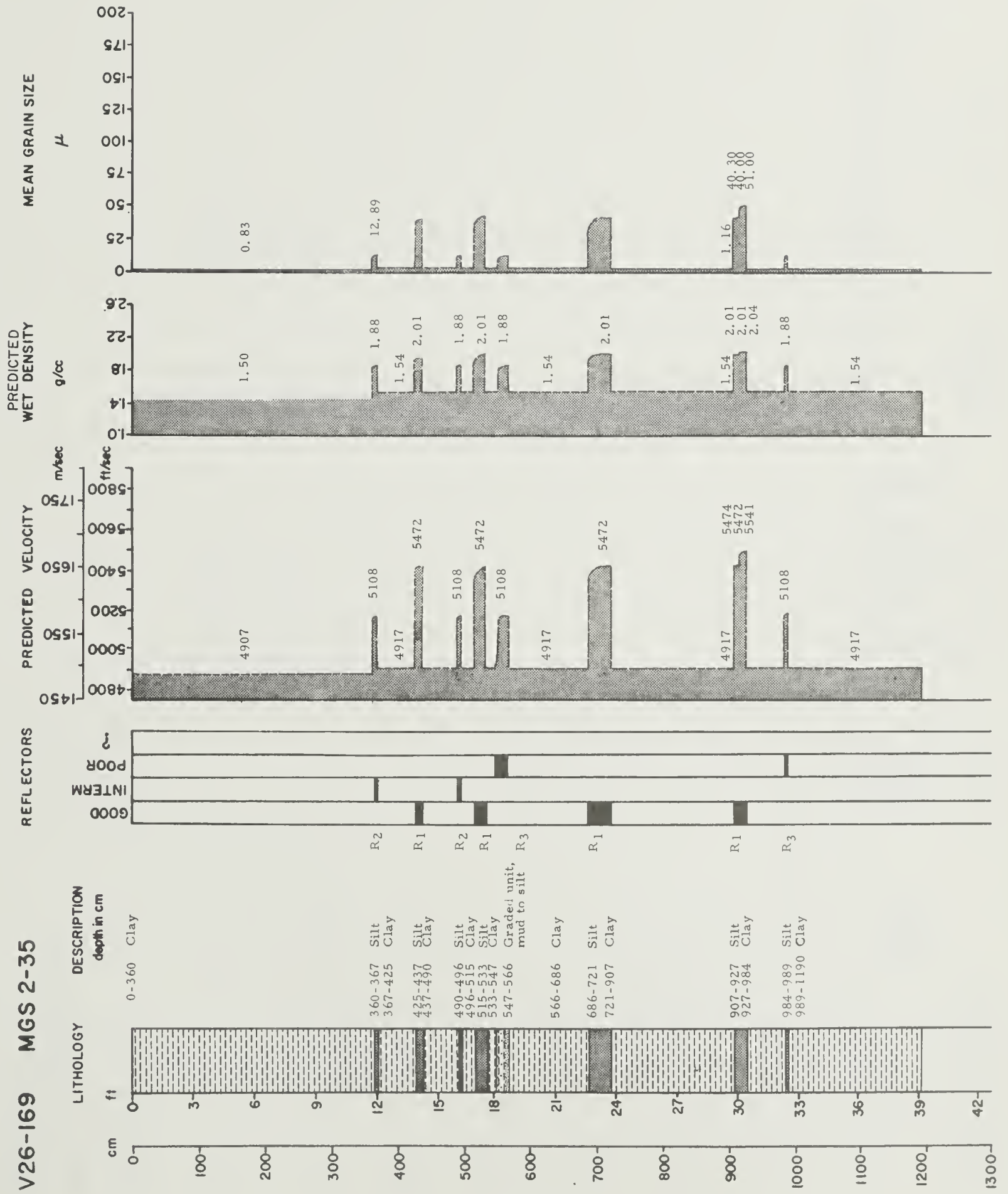


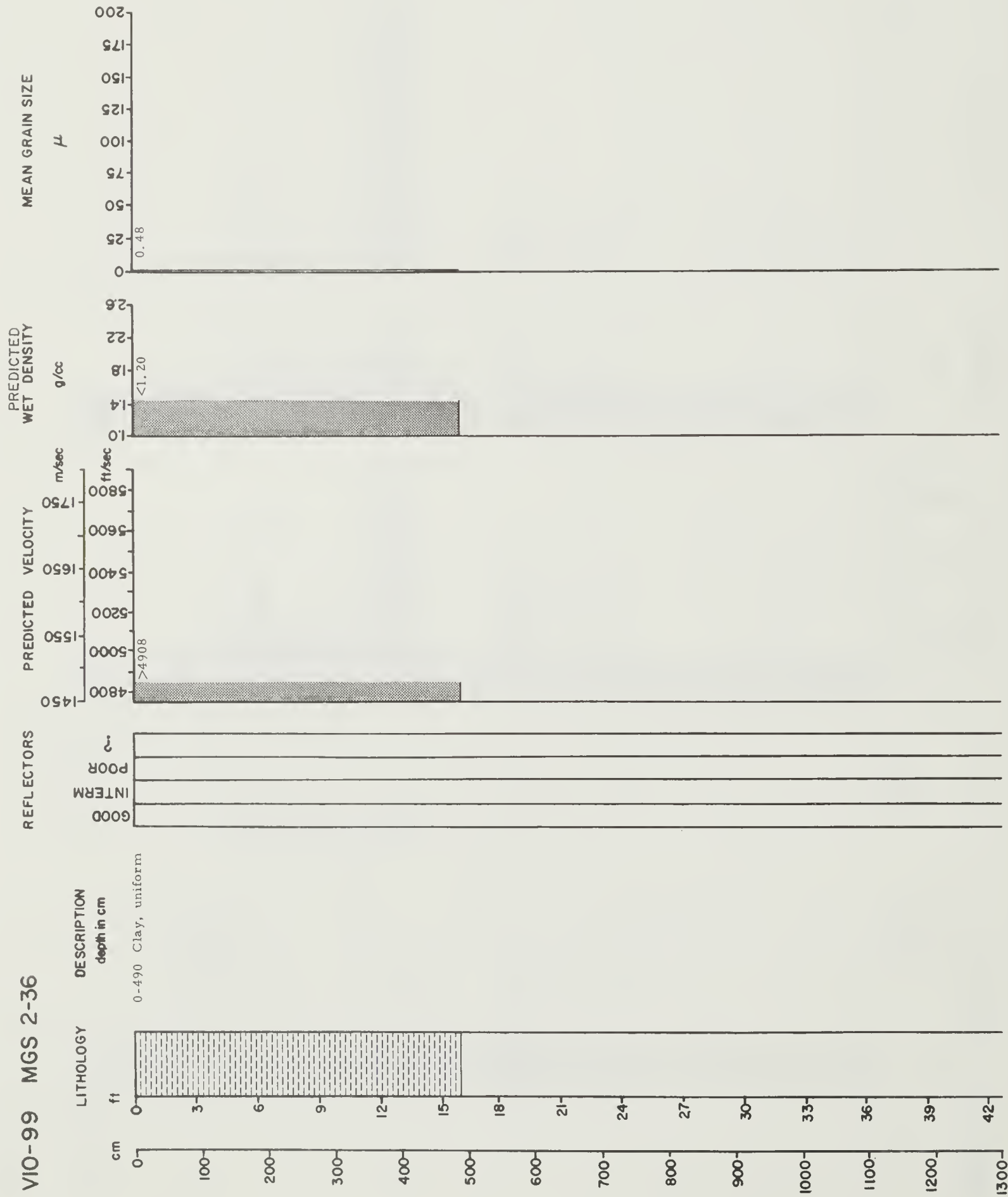
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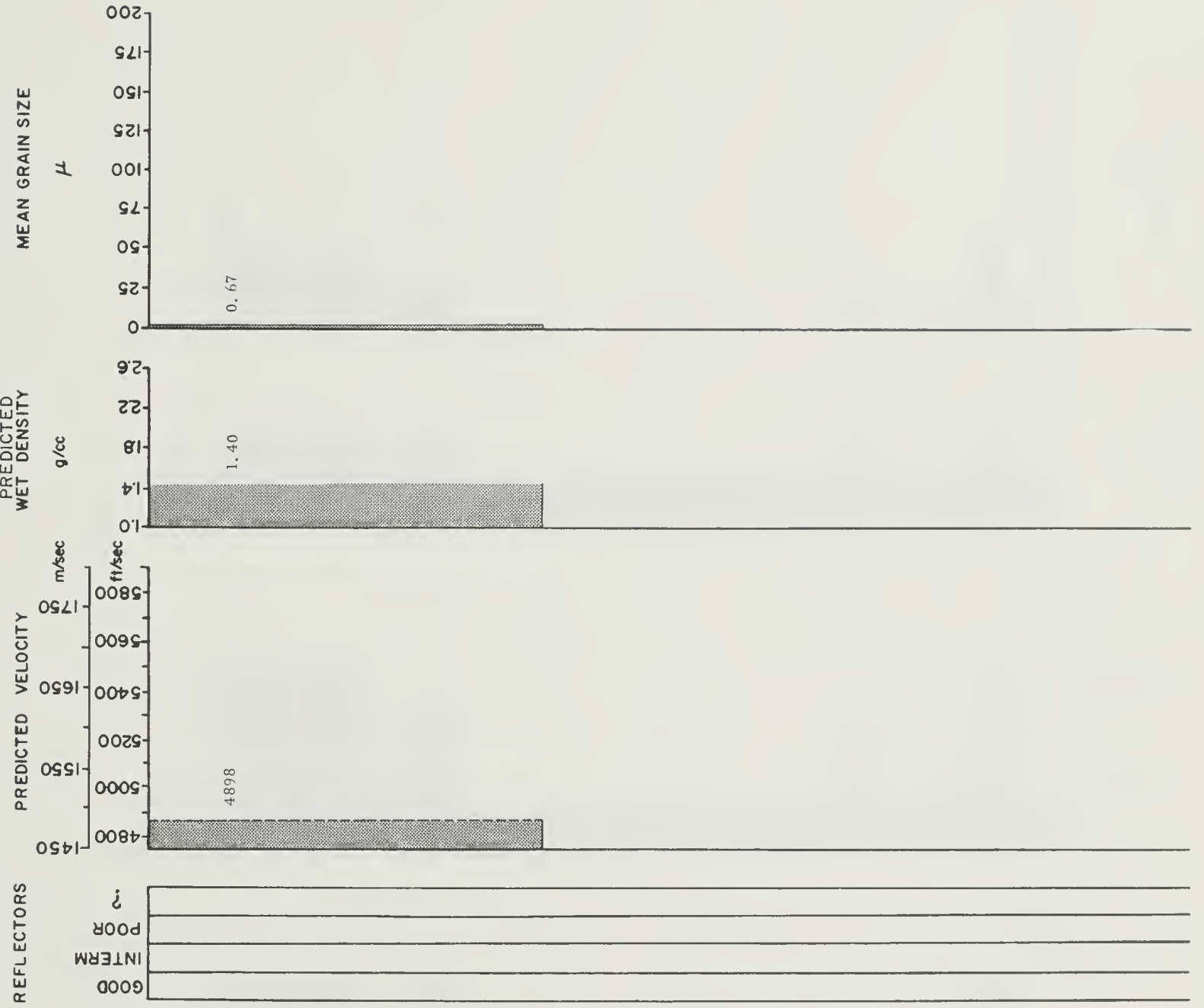
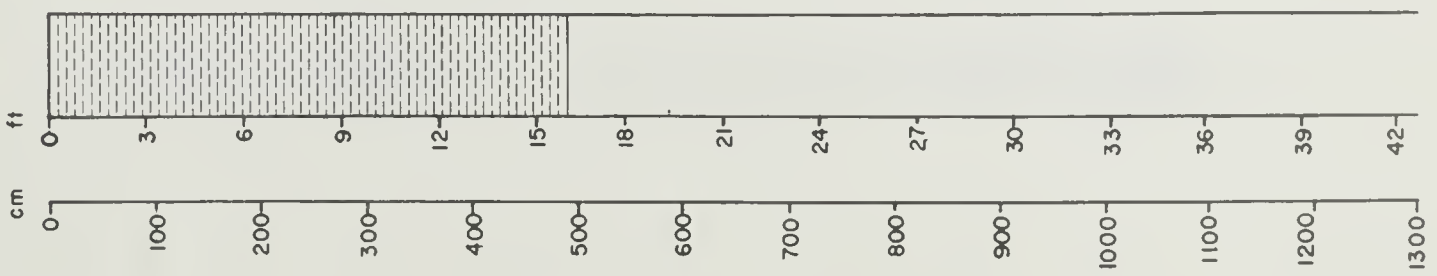
V26-169 MGS 2-35



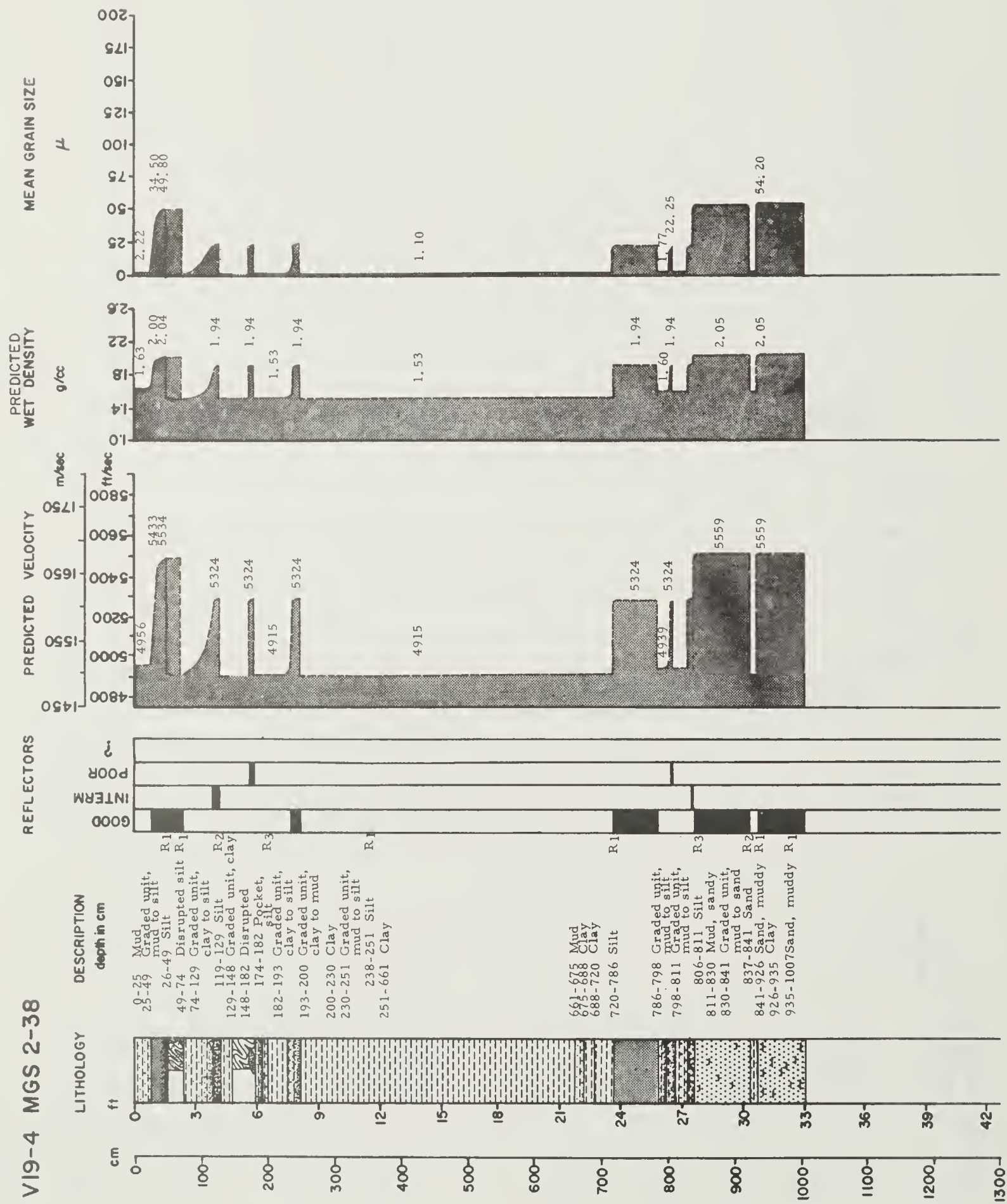


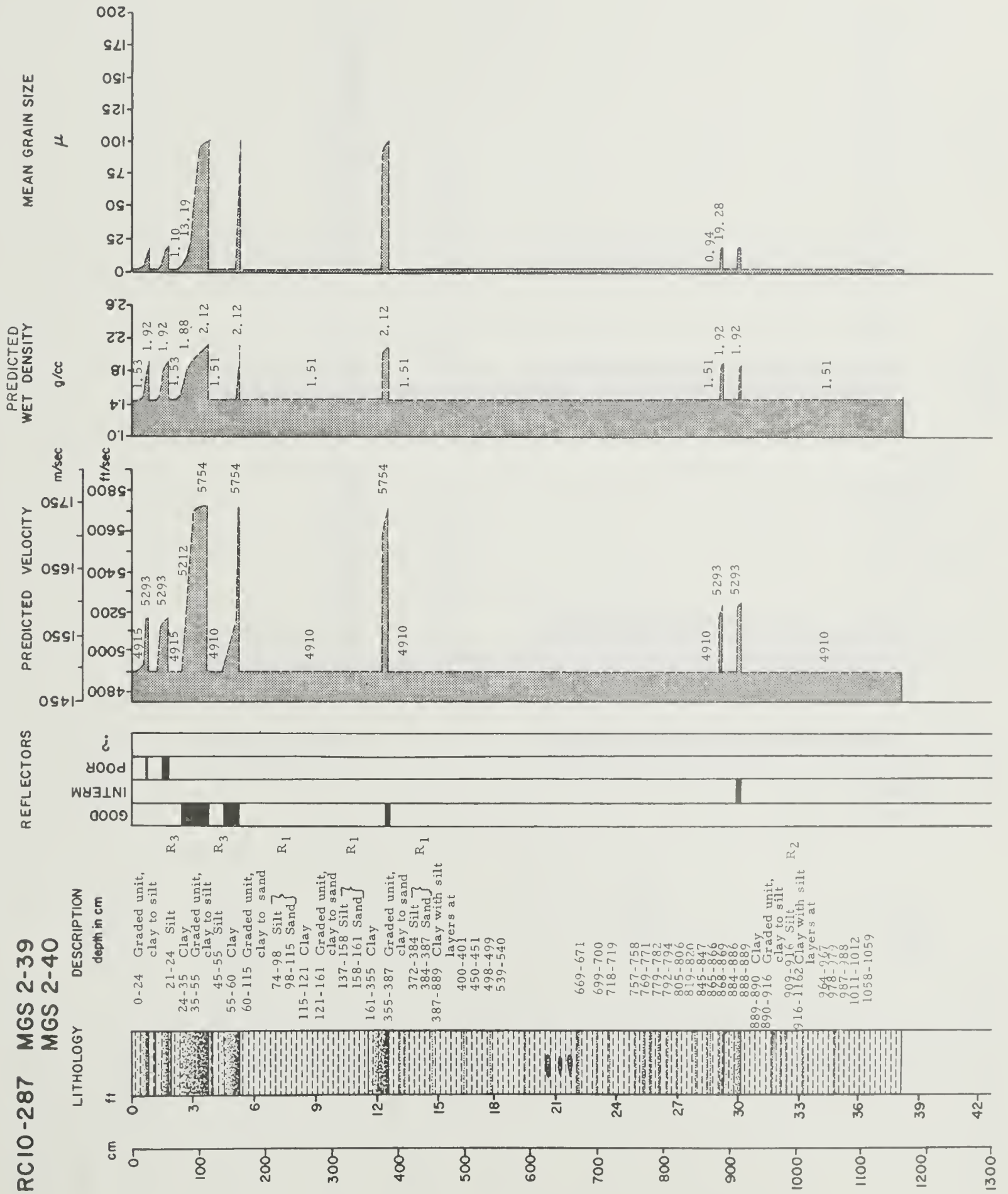
A179-21 MGS 2-37
MGS 2-55,56

LITHOLOGY DESCRIPTION
 depth in cm

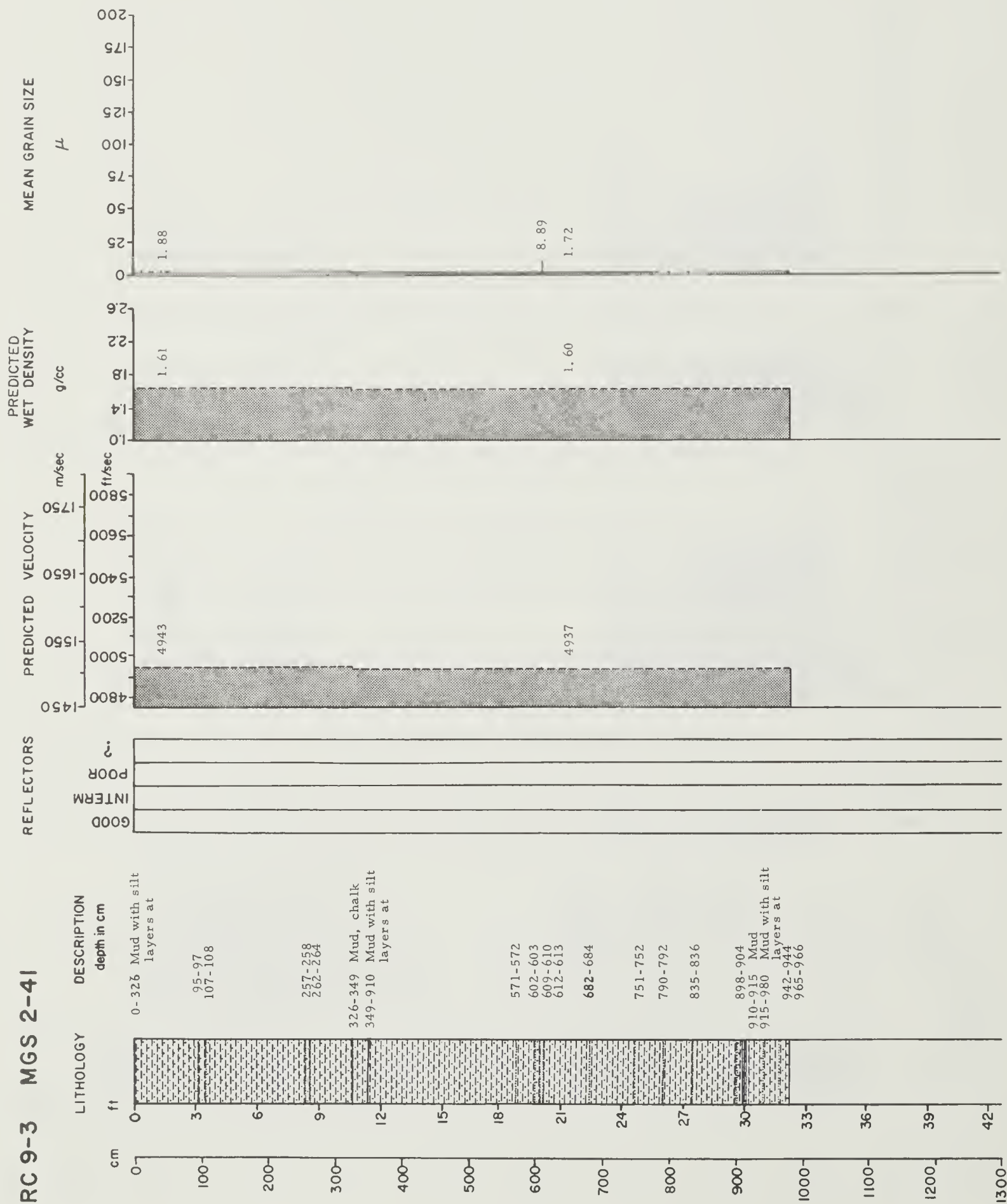


V19-4 MGS 2-38

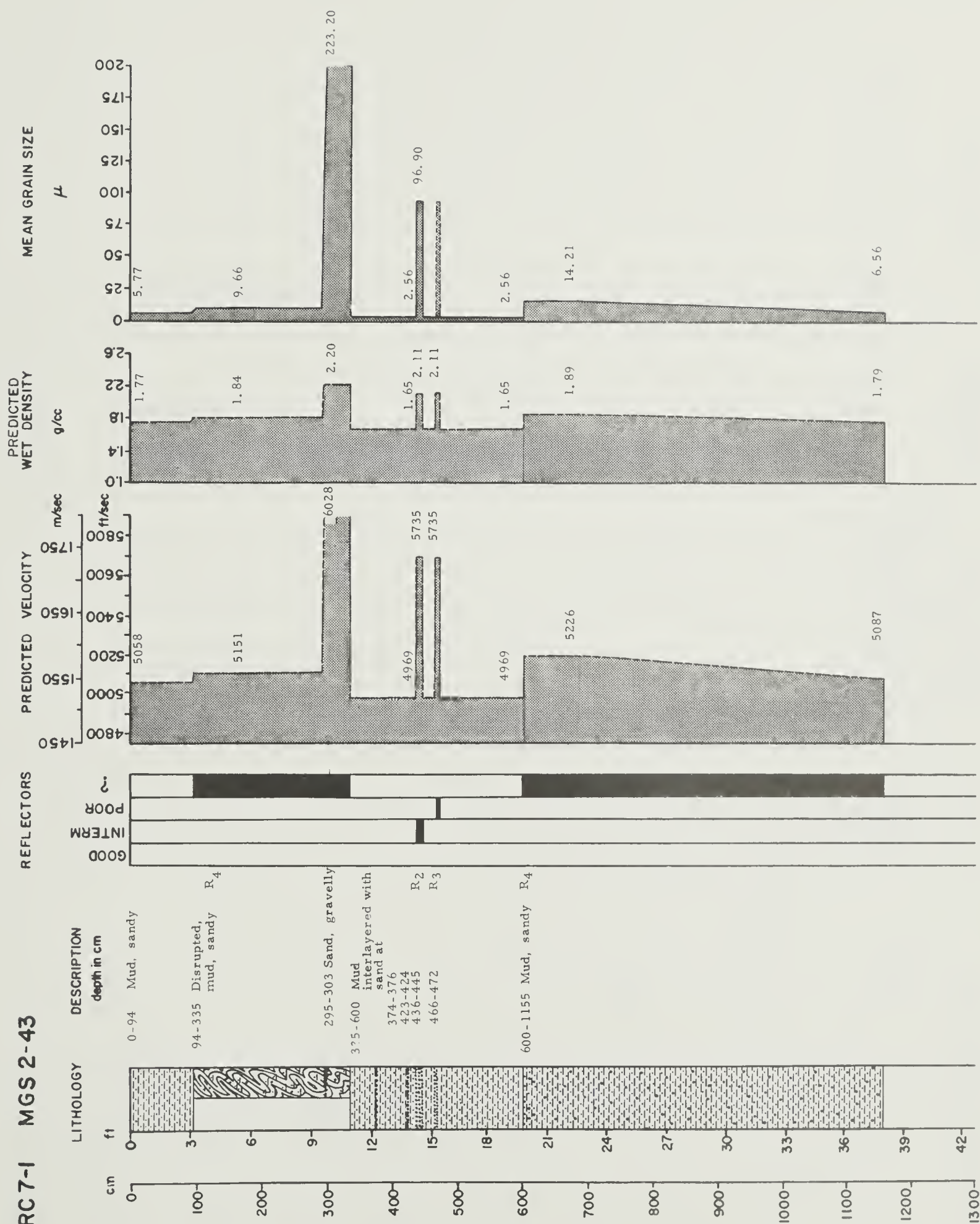




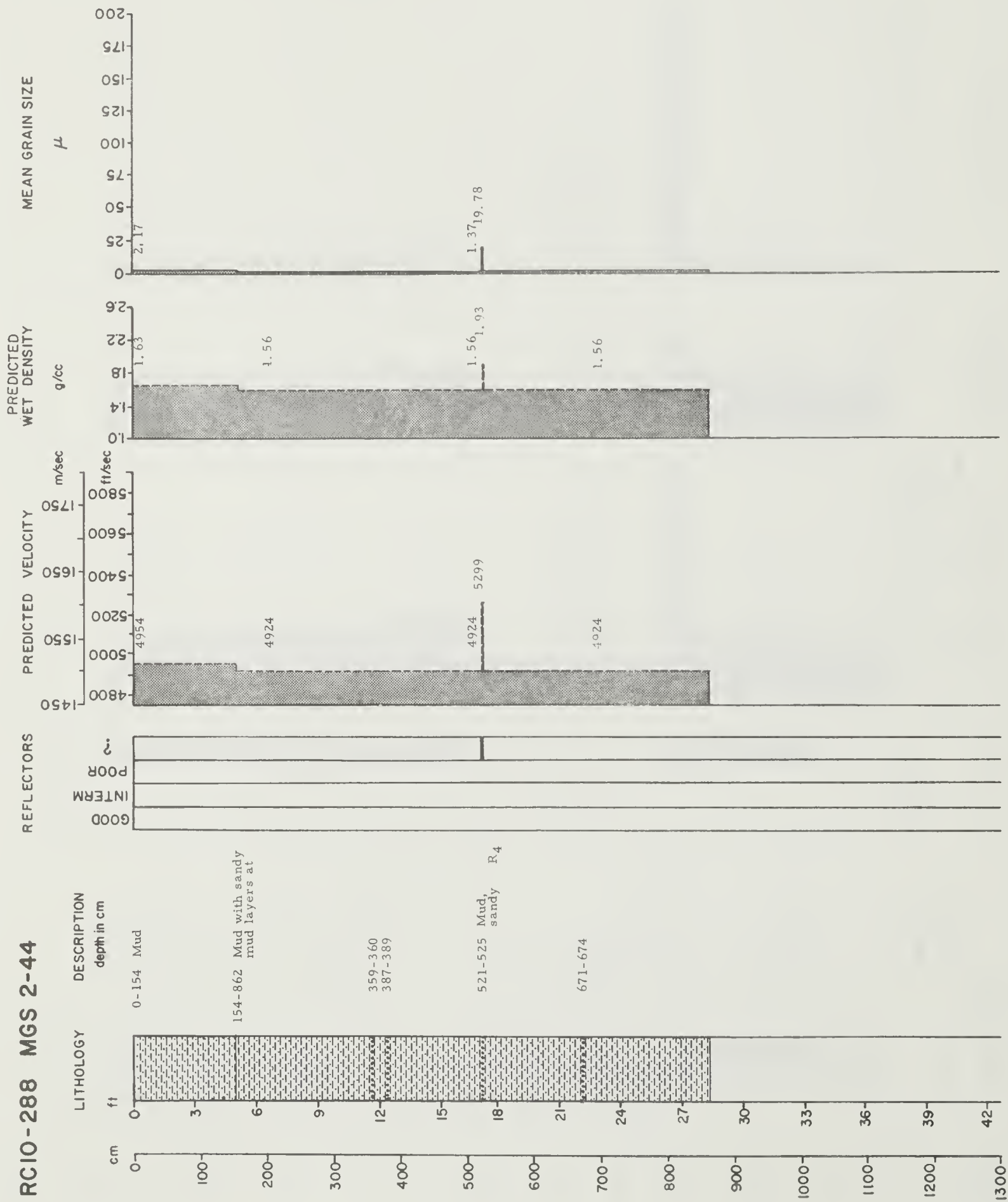
RC 9-3 MGS 2-41

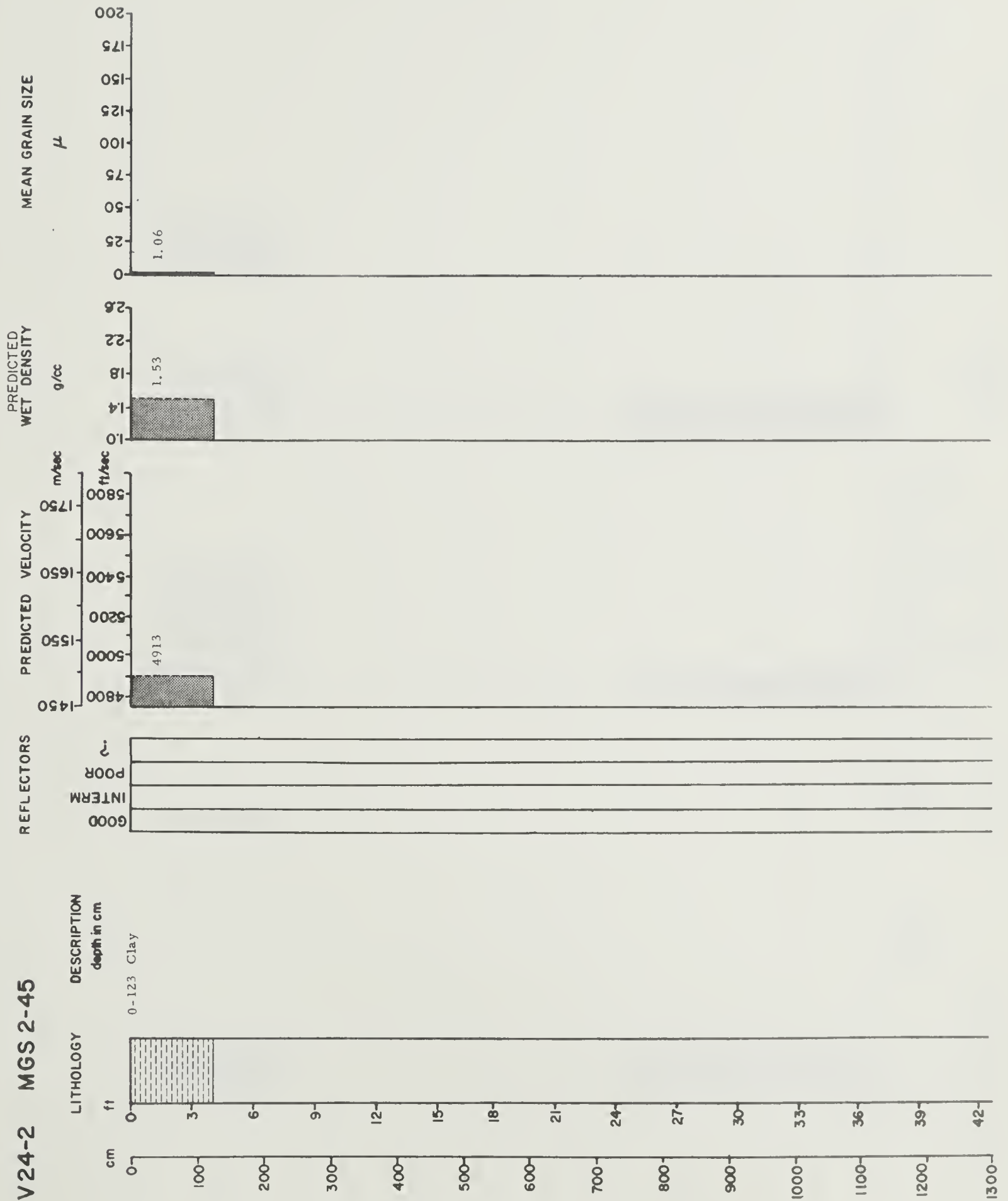


RC 7-1 MGS 2-43

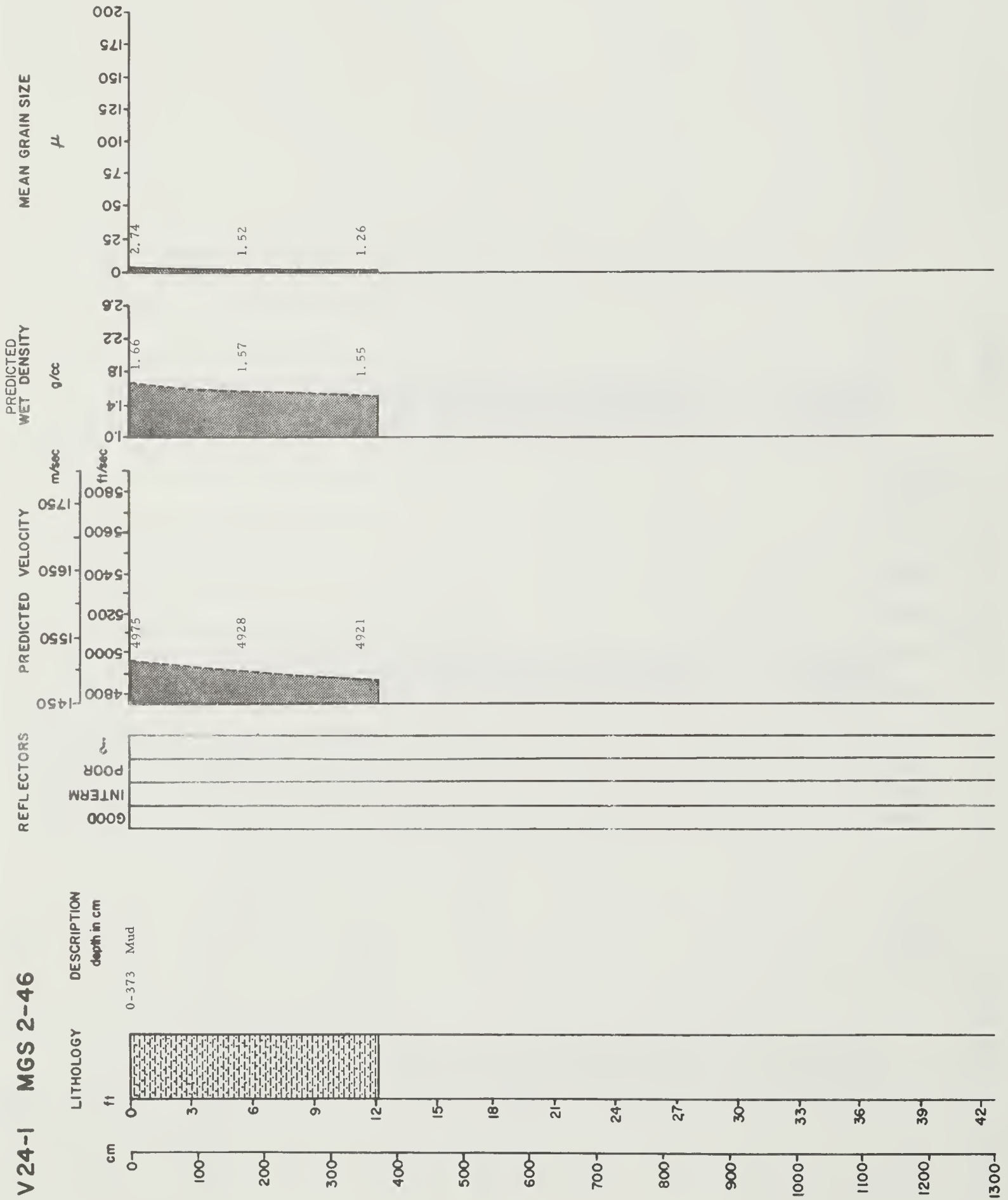


RCIO-288 MGS 2-44

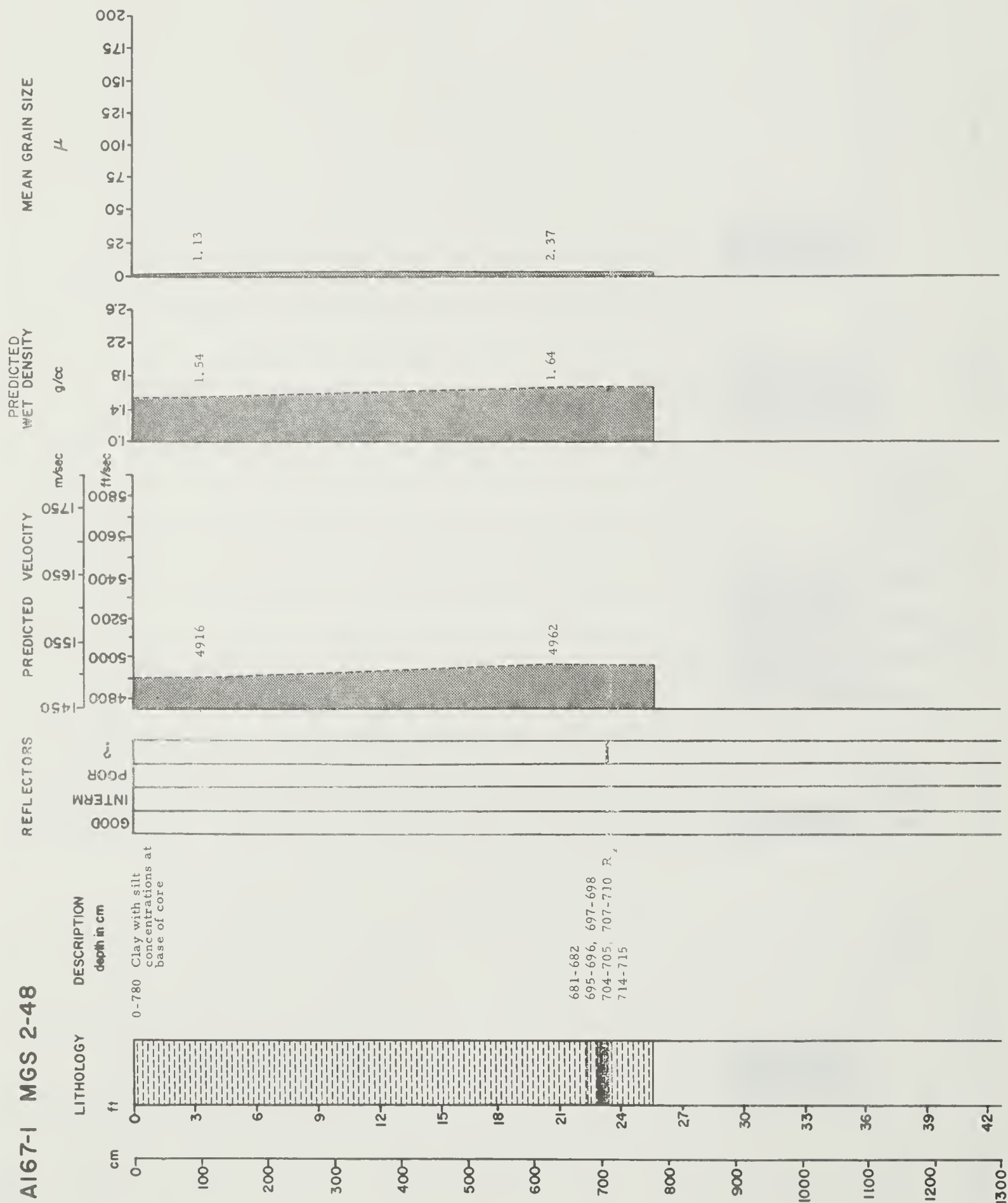




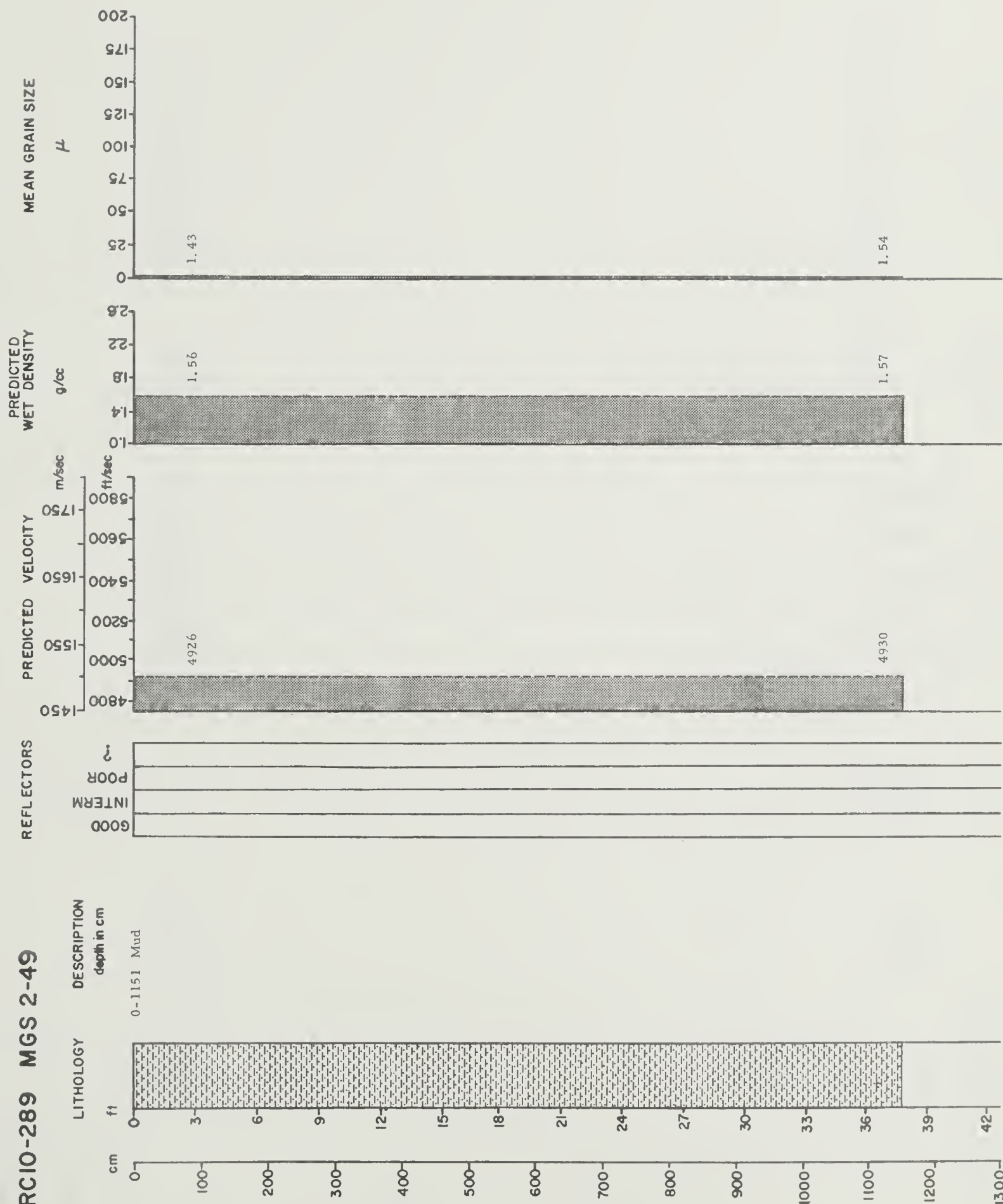
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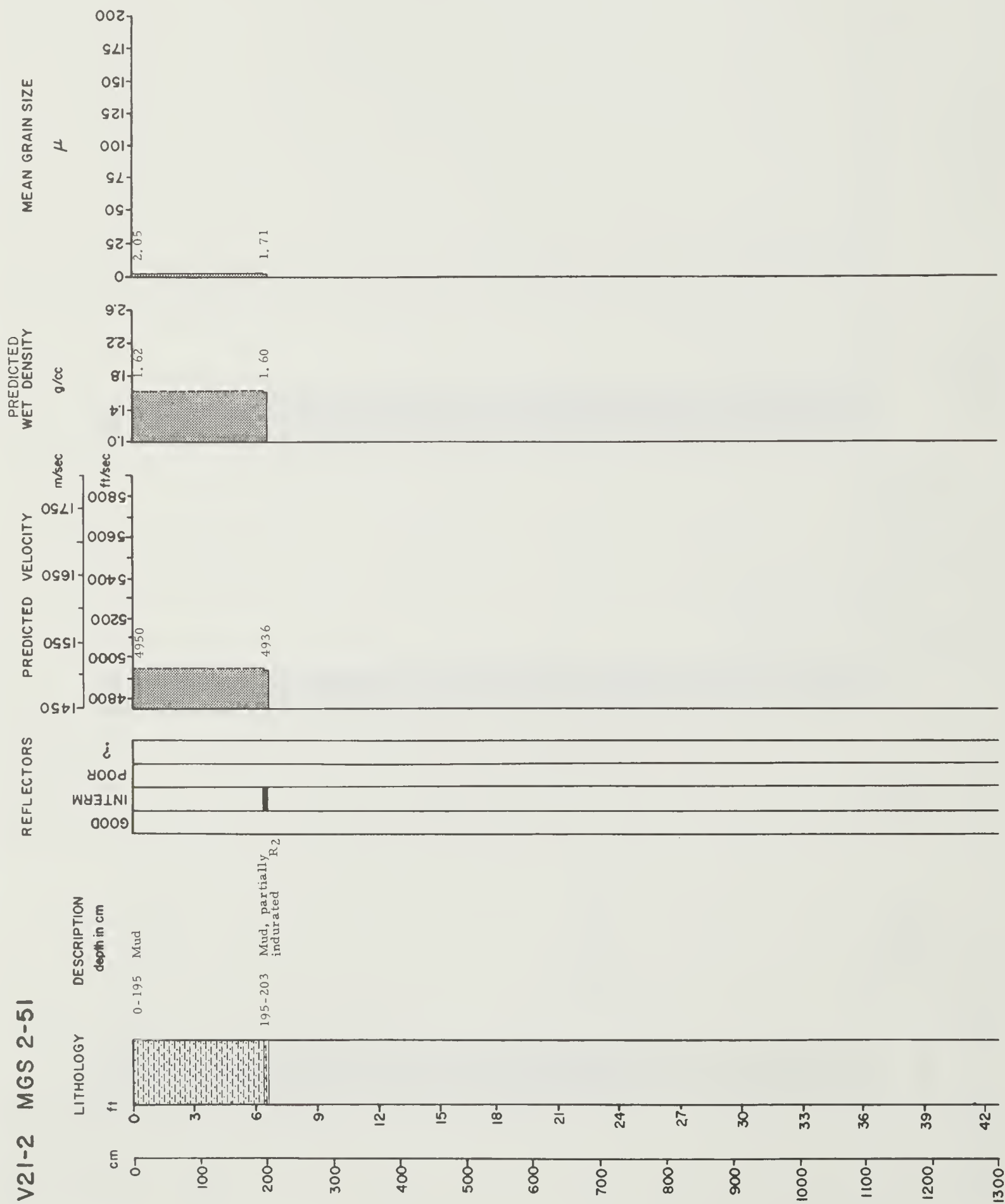
AI67-1 MGS 2-48



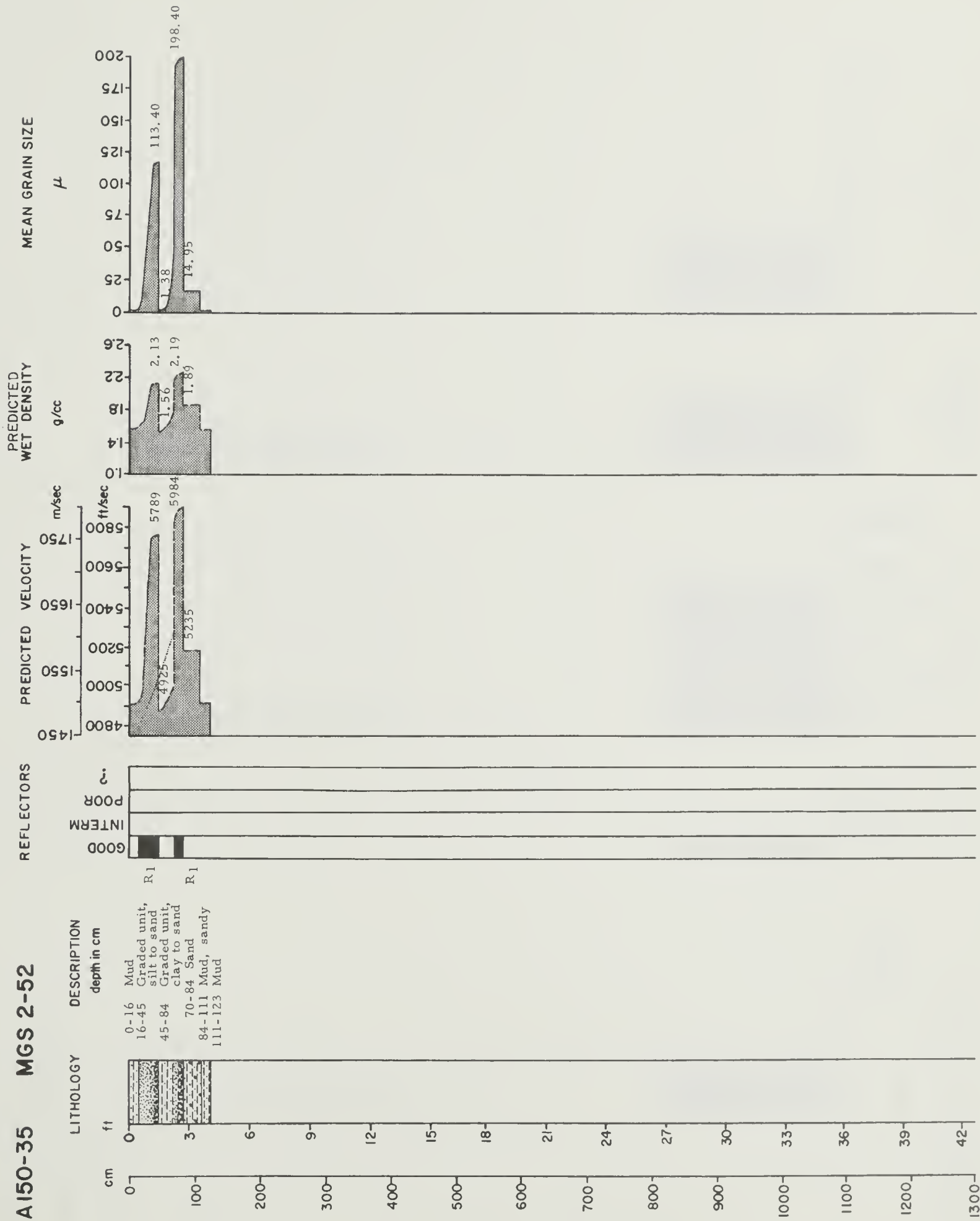
RCIO-289 MGS 2-49



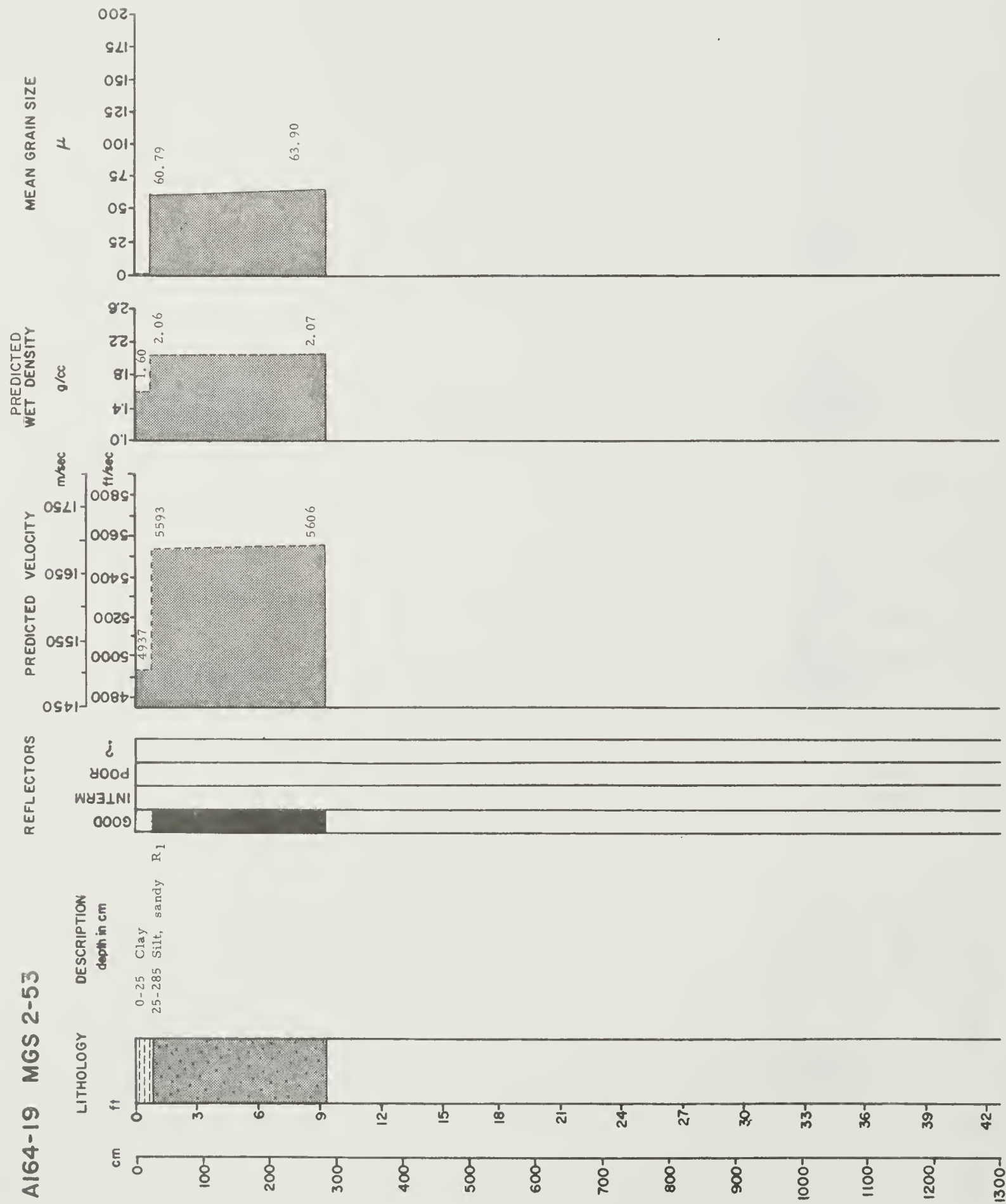
V21-2 MGS 2-51

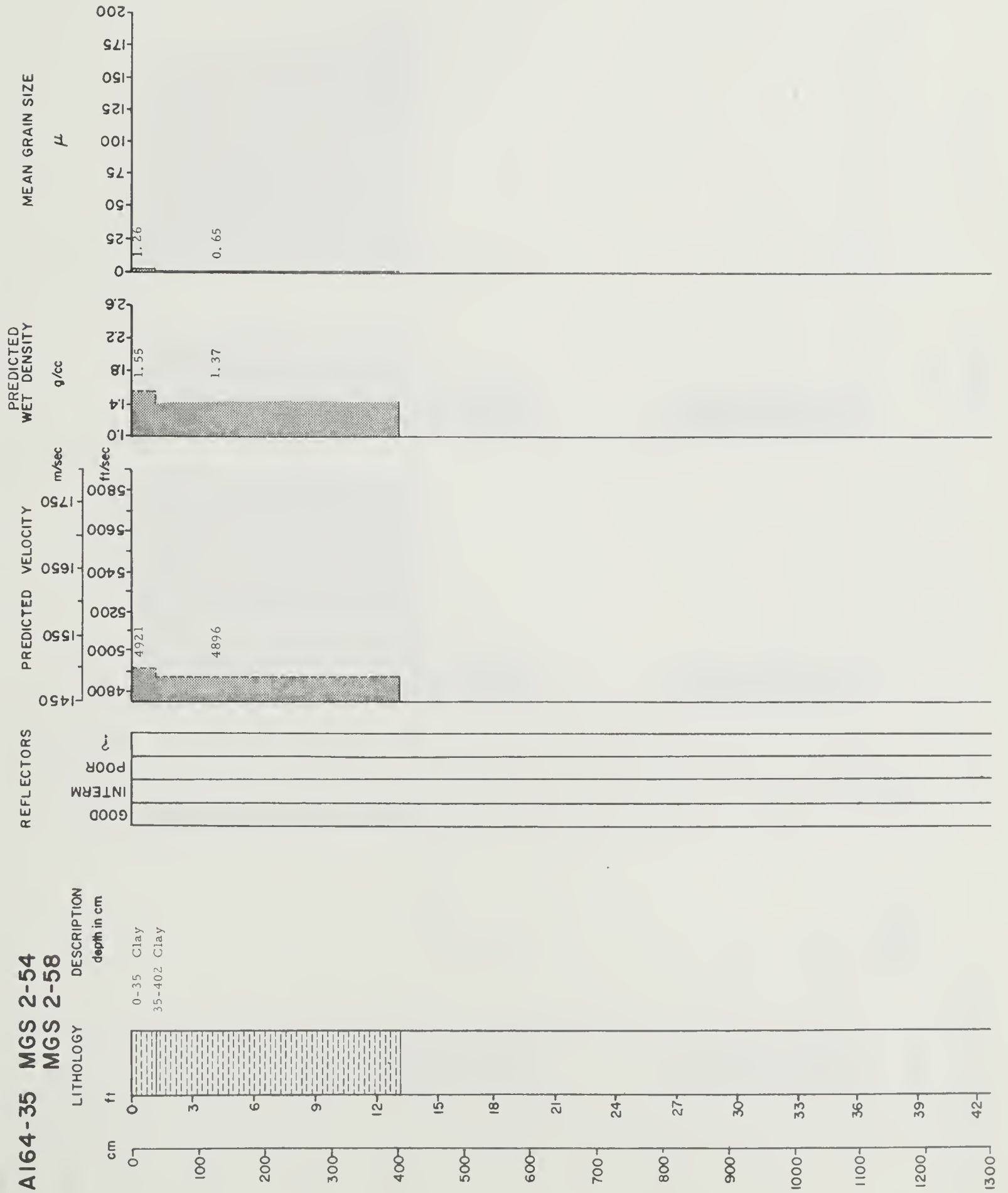


A150-35 MGS 2-52

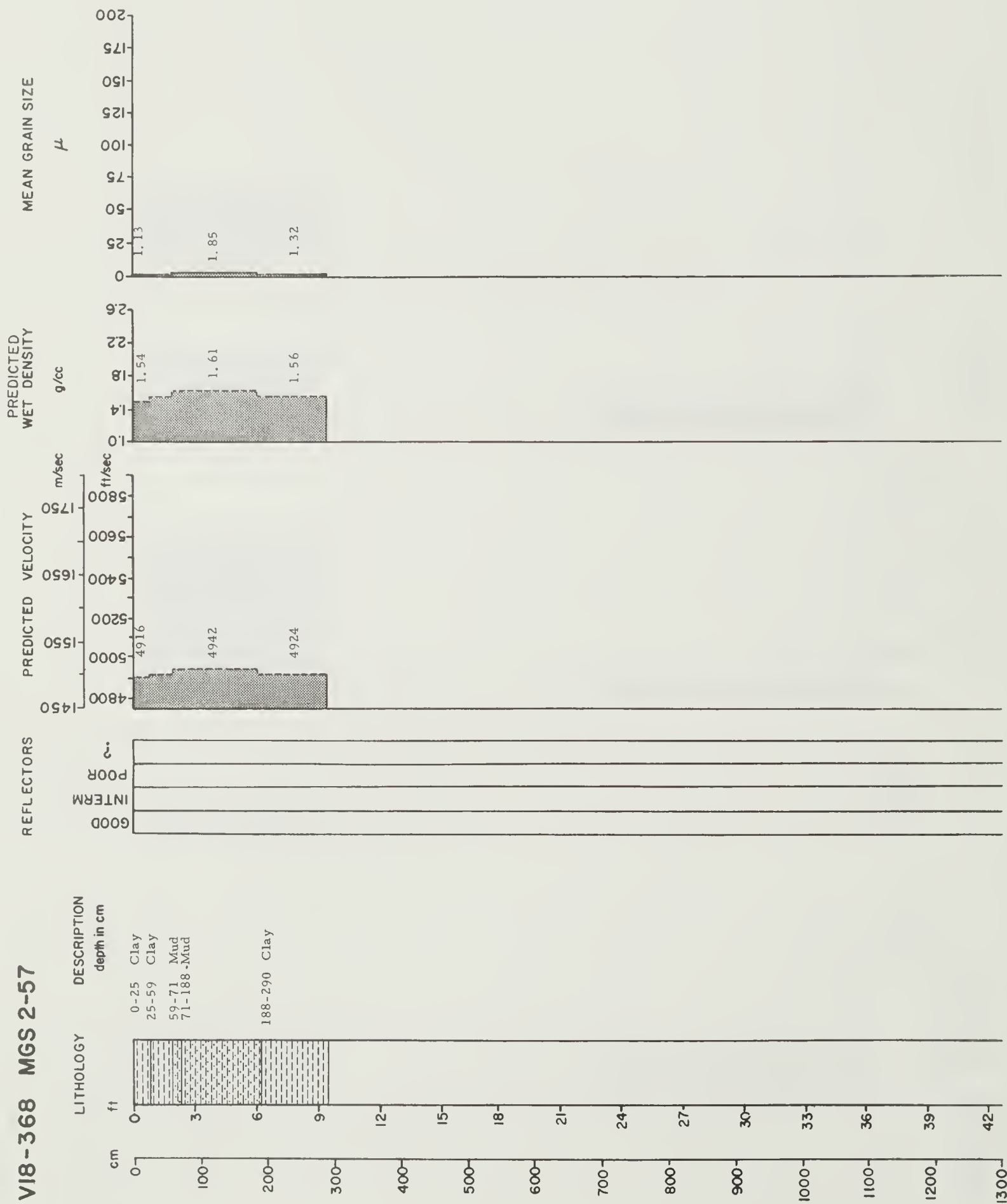


A164-19 MGS 2-53

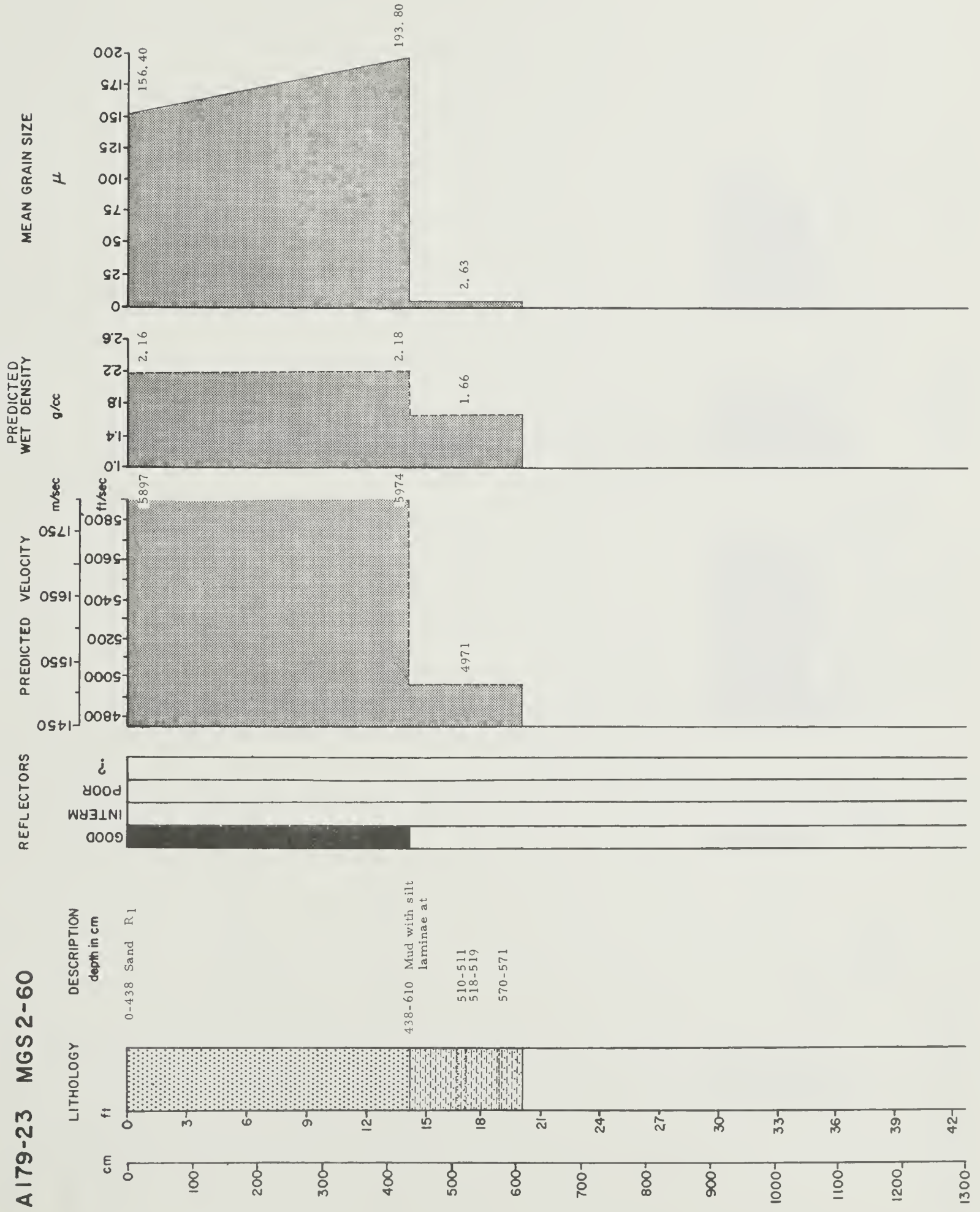




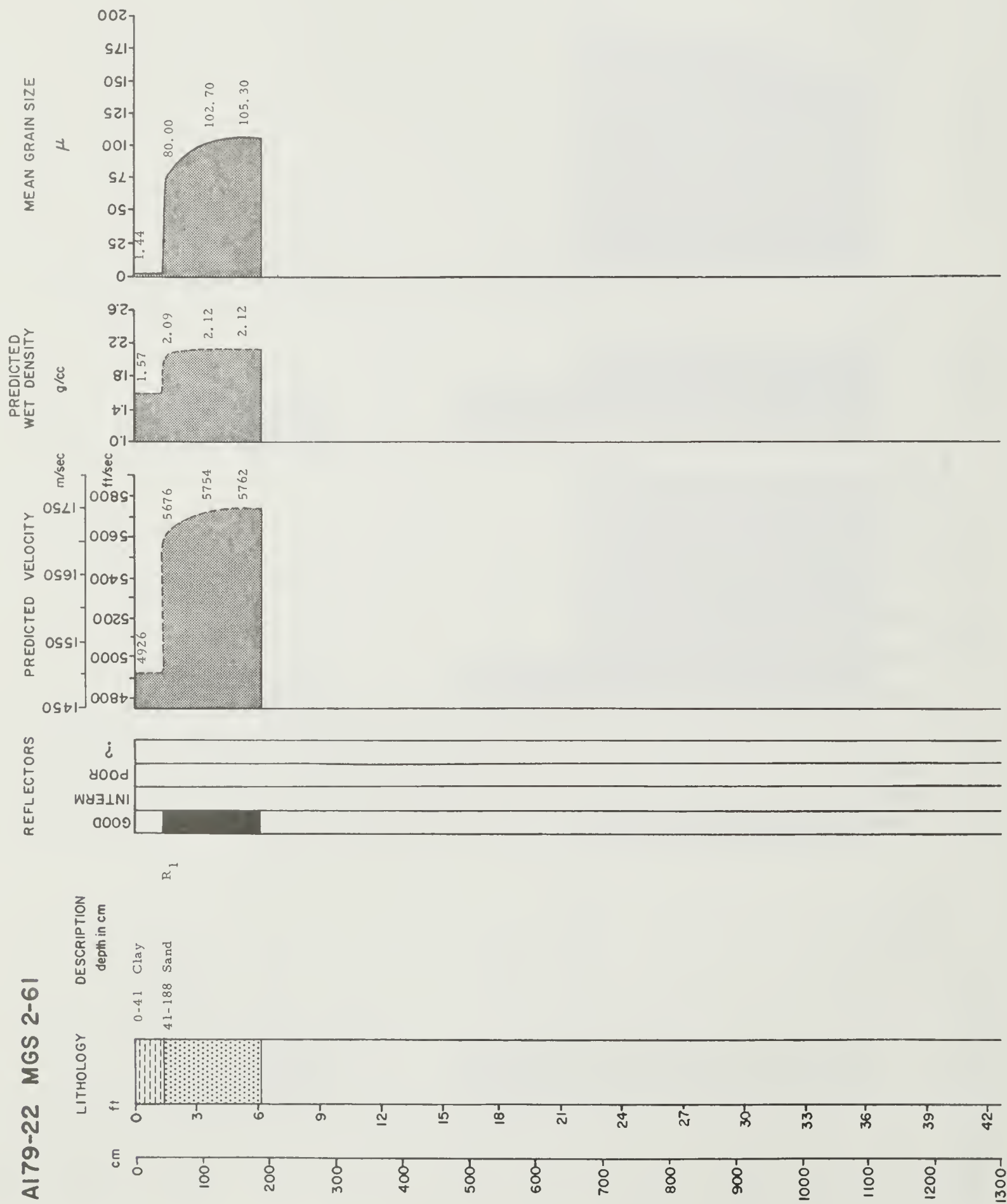
VI8-368 MGS 2-57



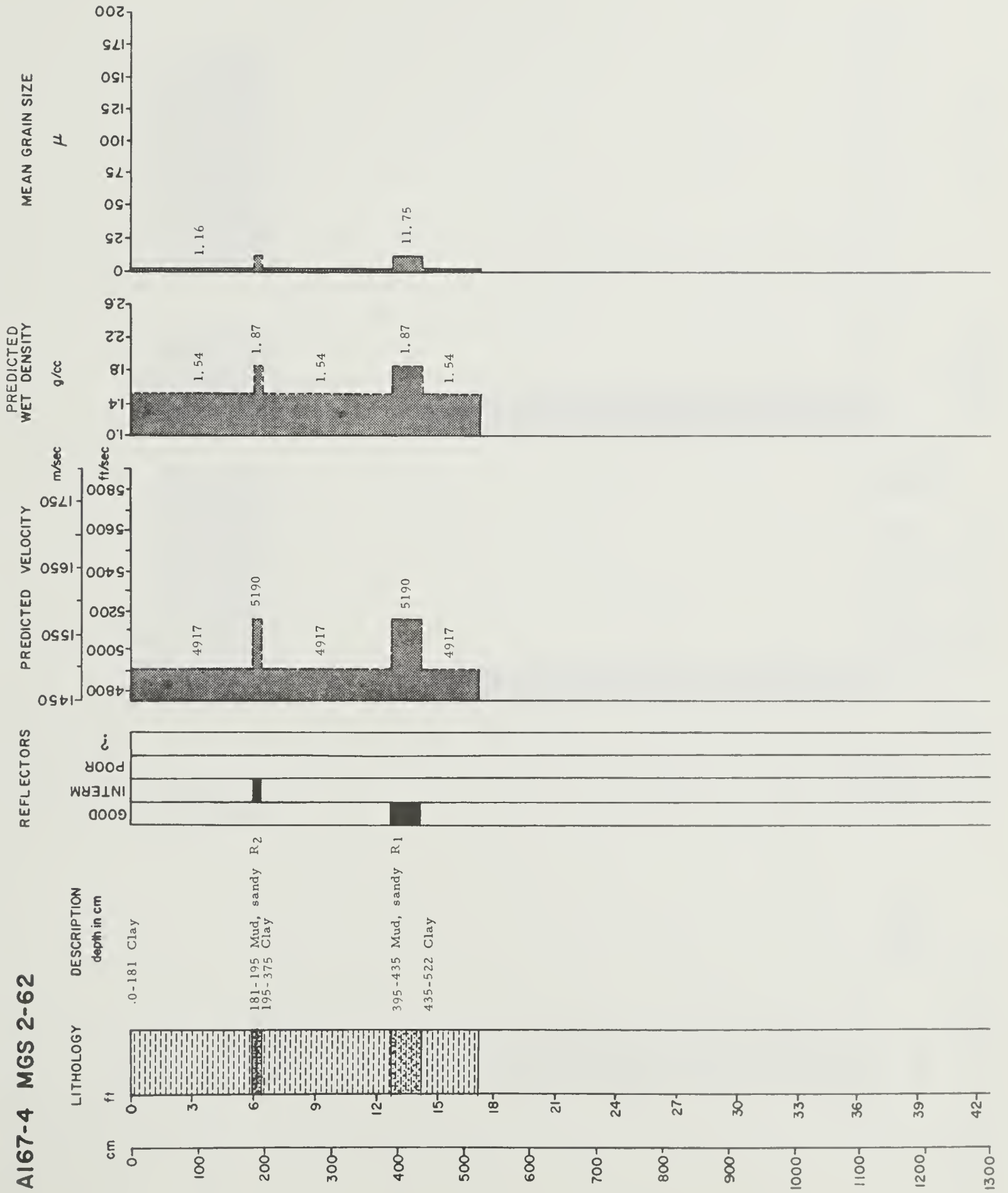
A179-23 MGS 2-60



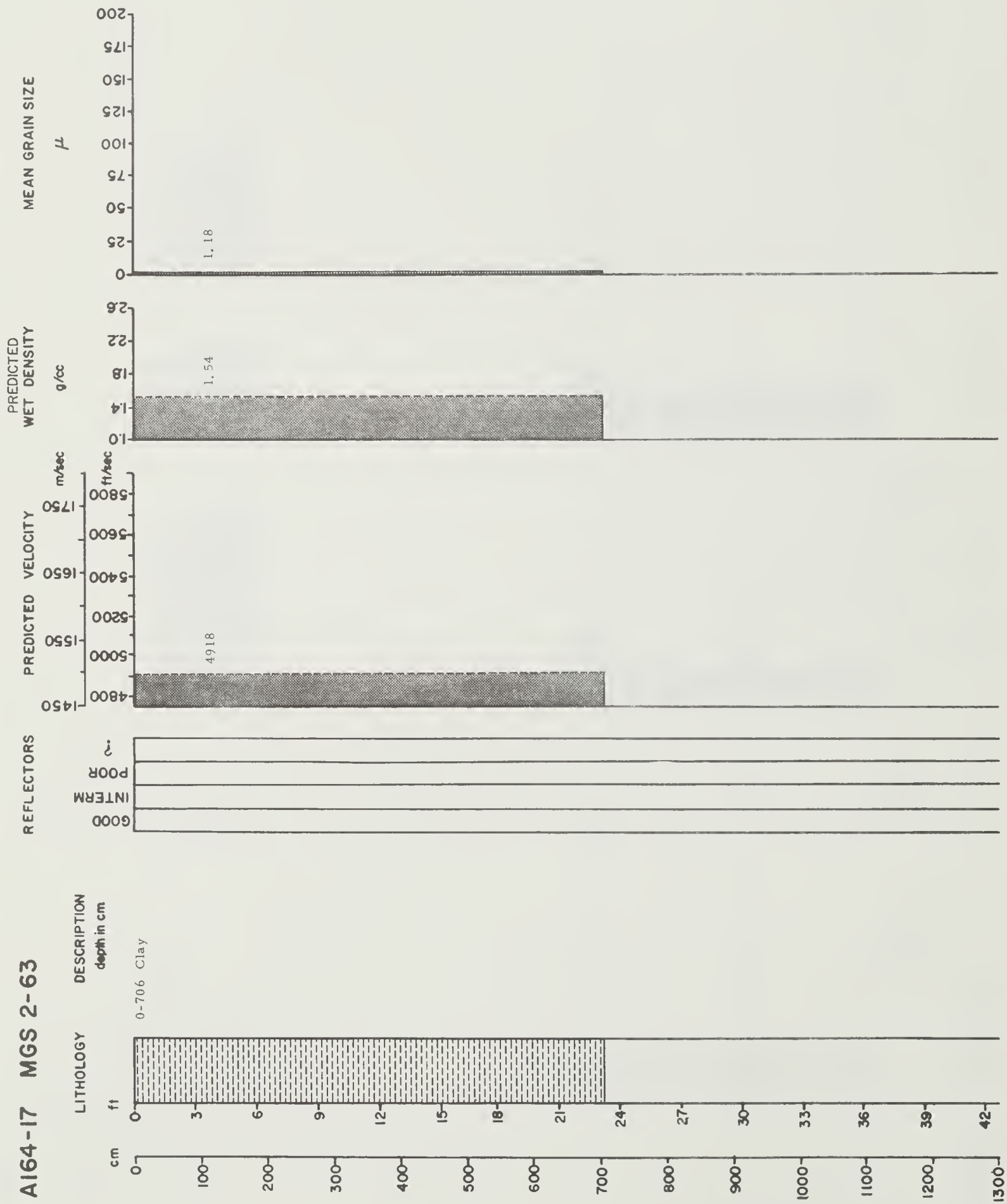
A179-22 MGS 2-61



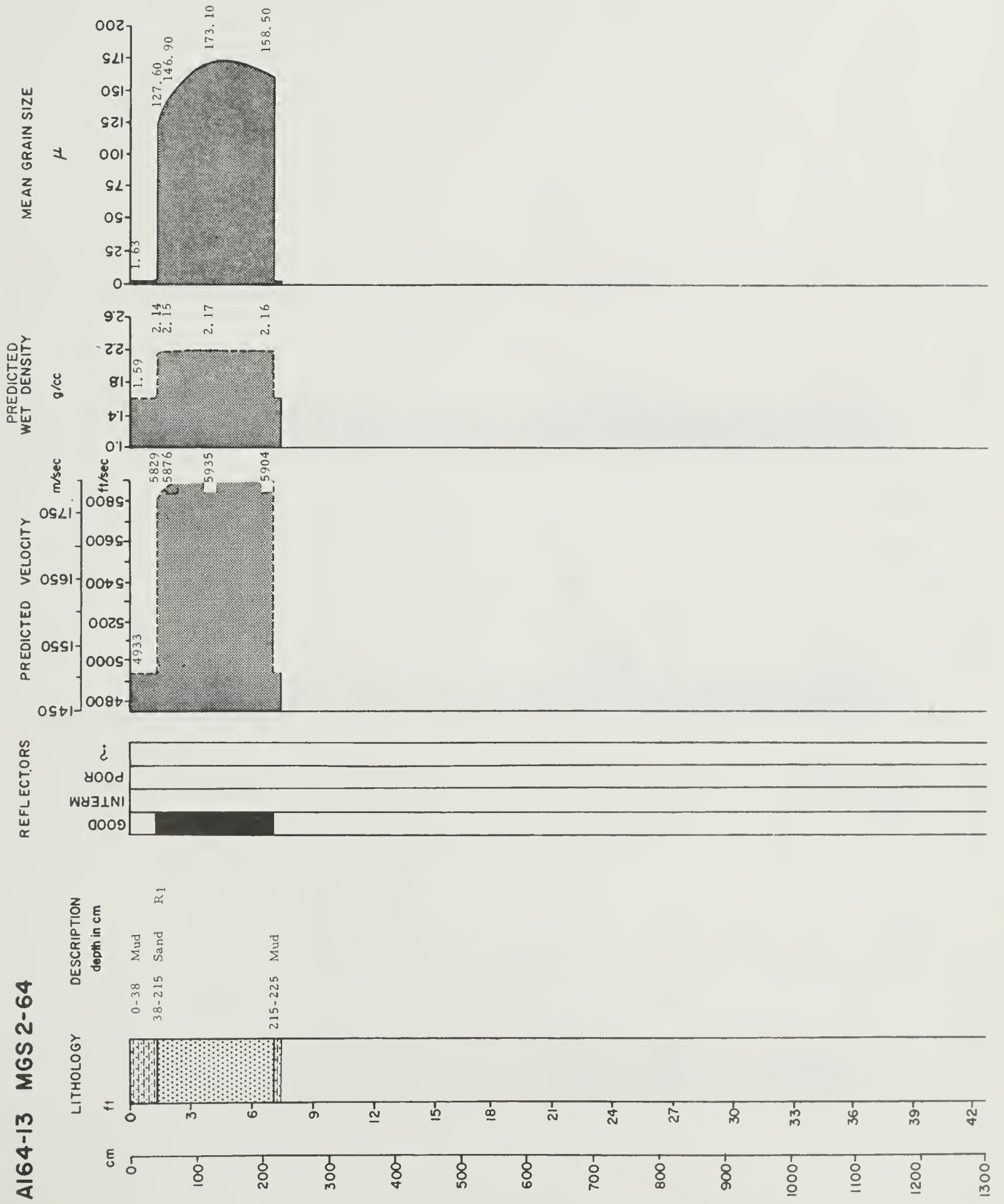
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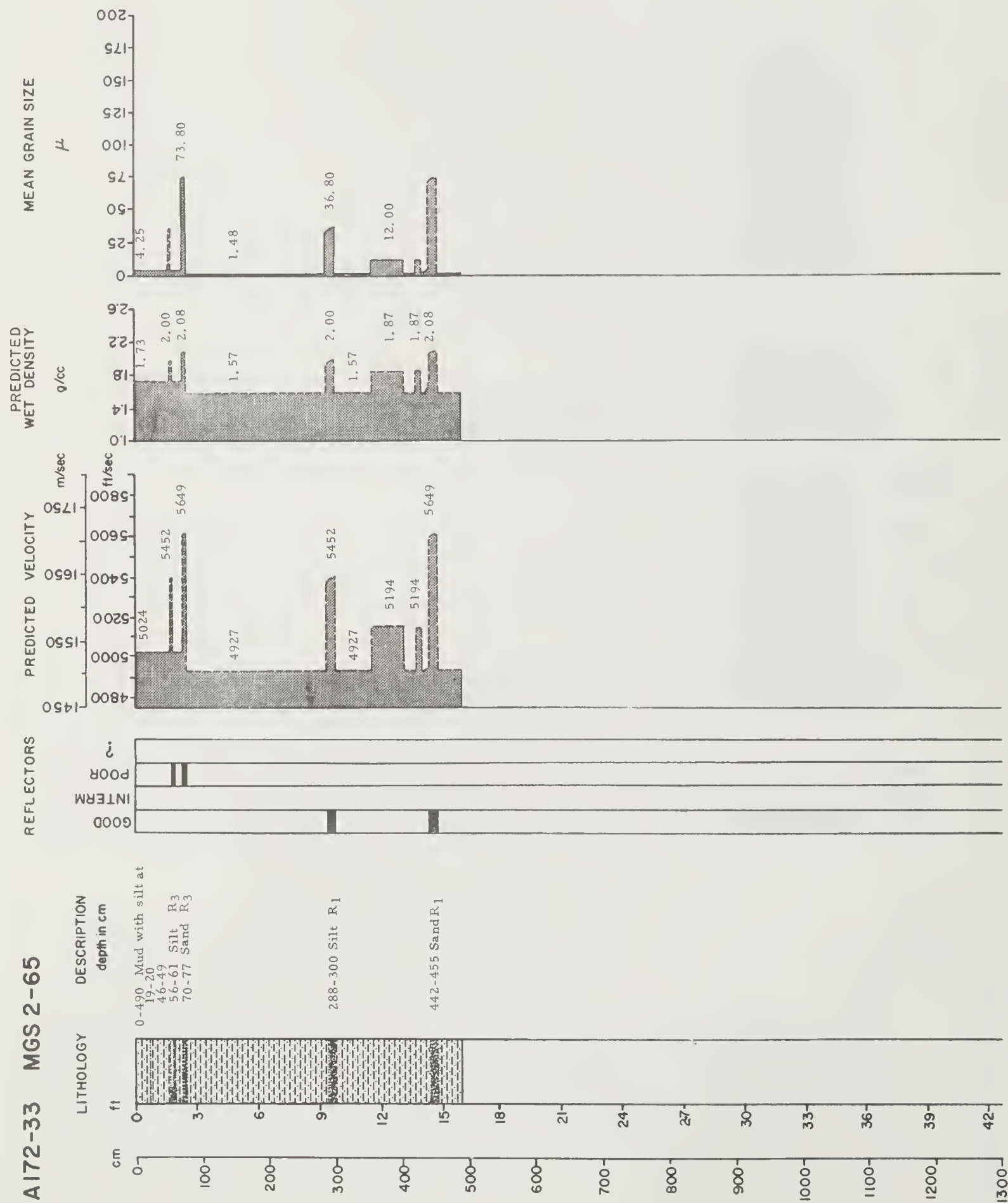


AI64-17 MGS 2-63

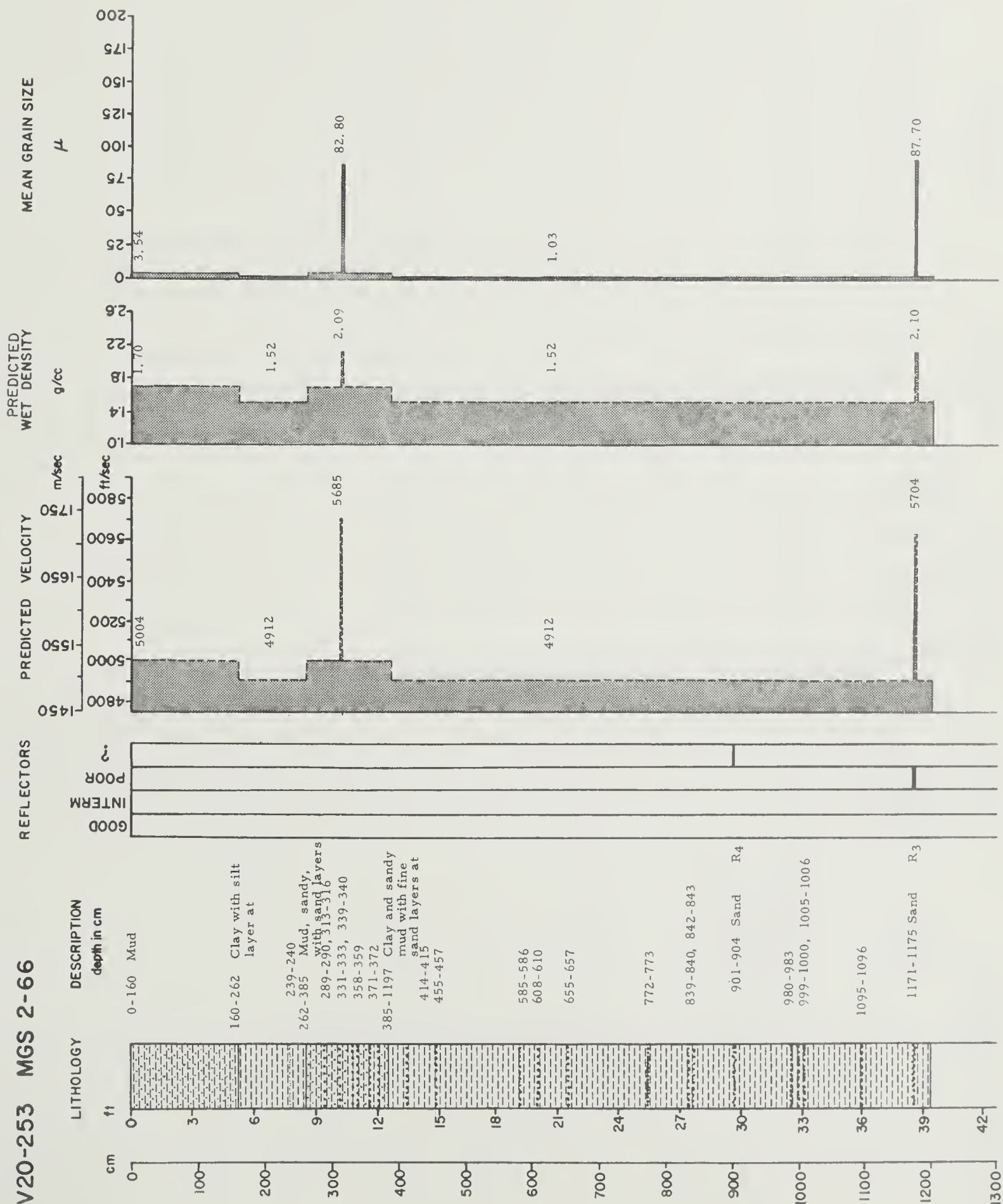


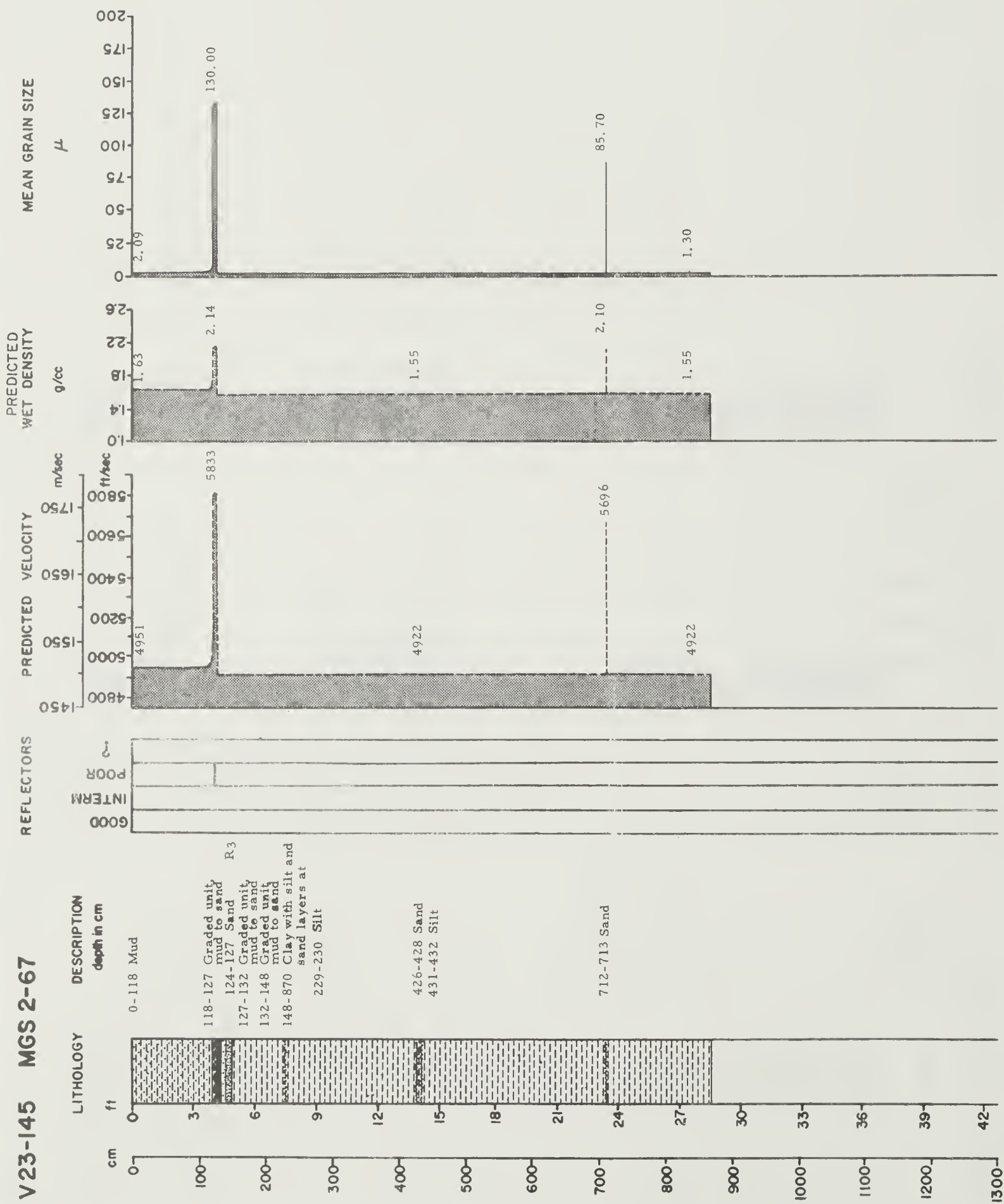
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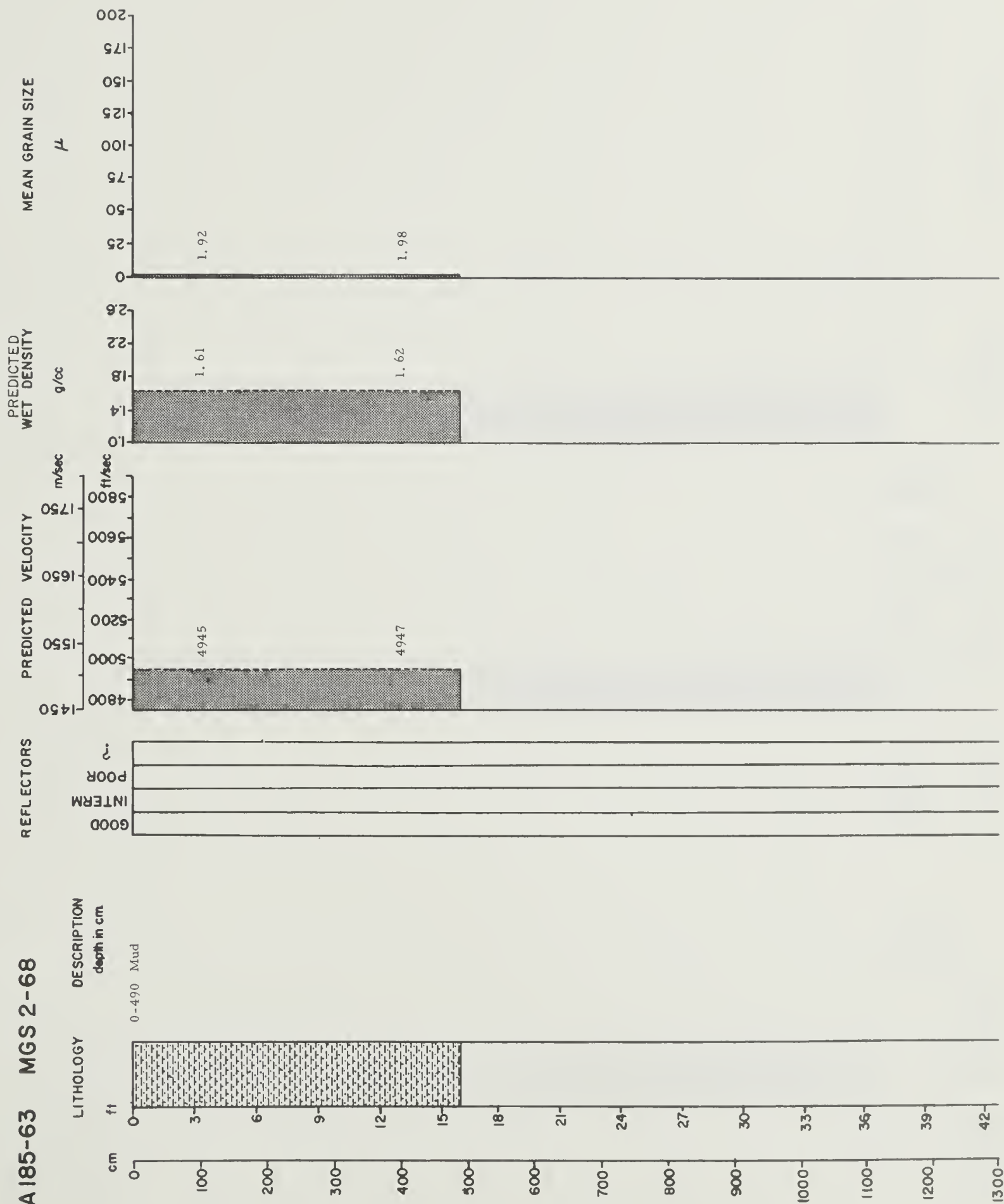




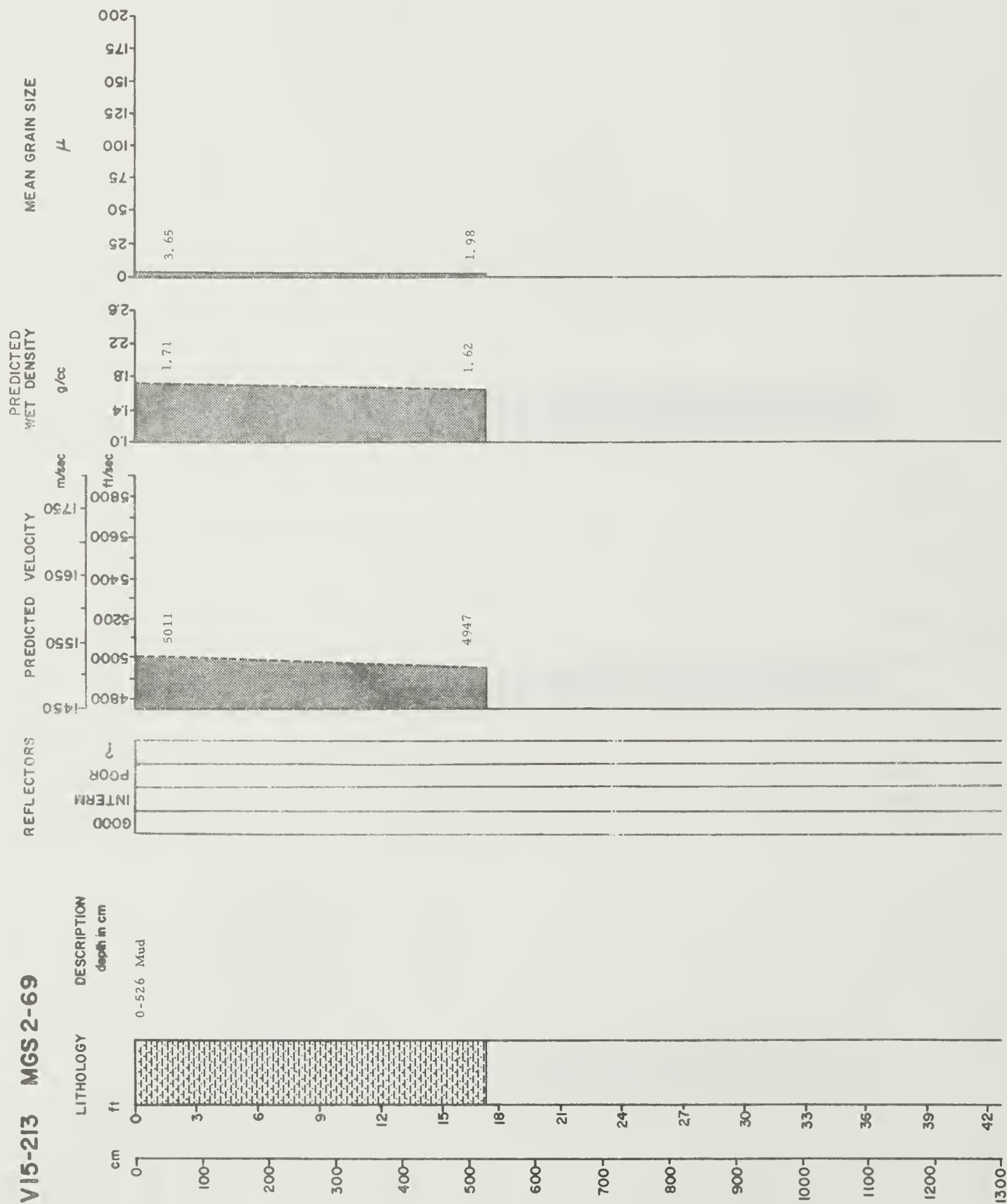
V20-253 MGS 2-66



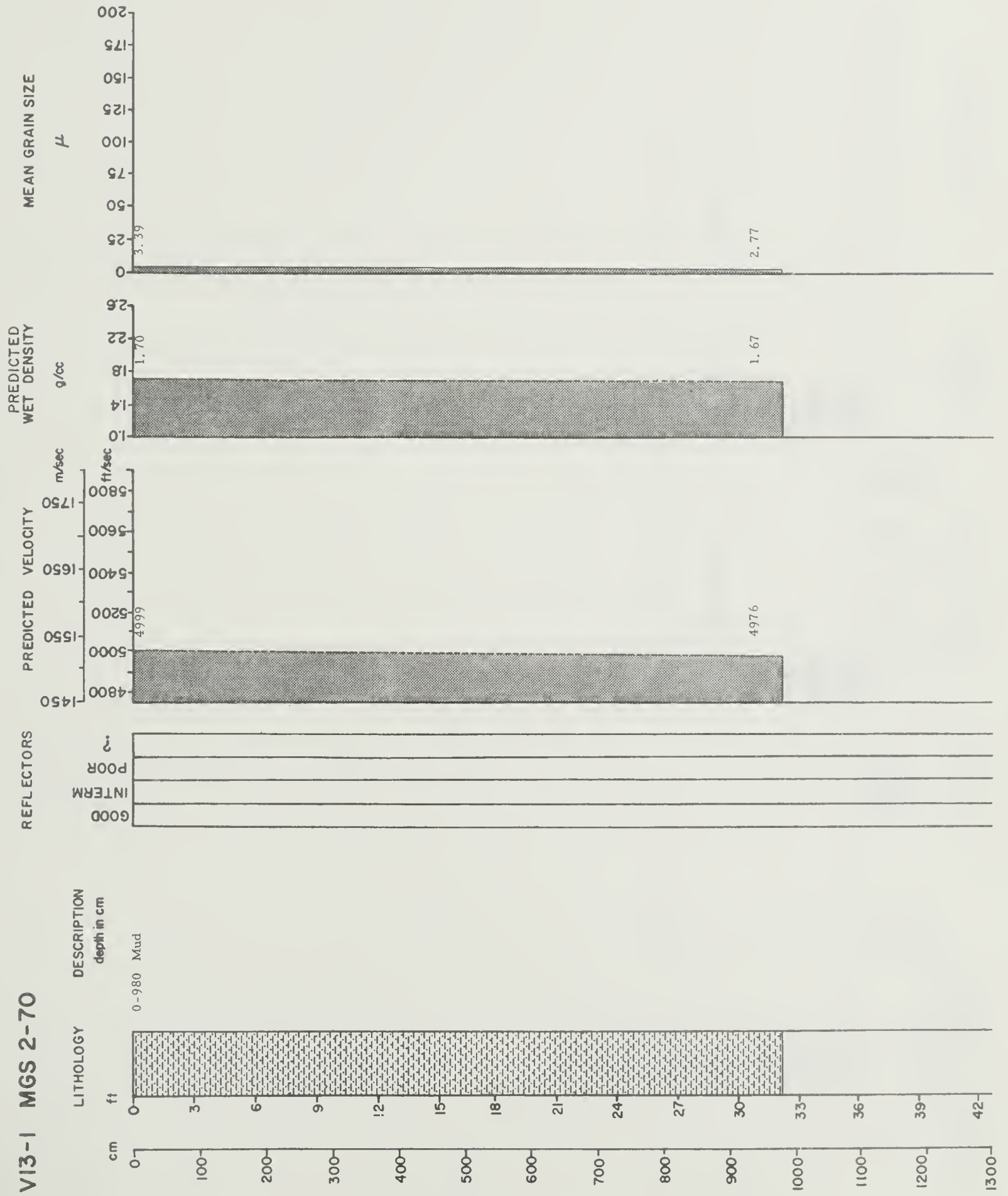




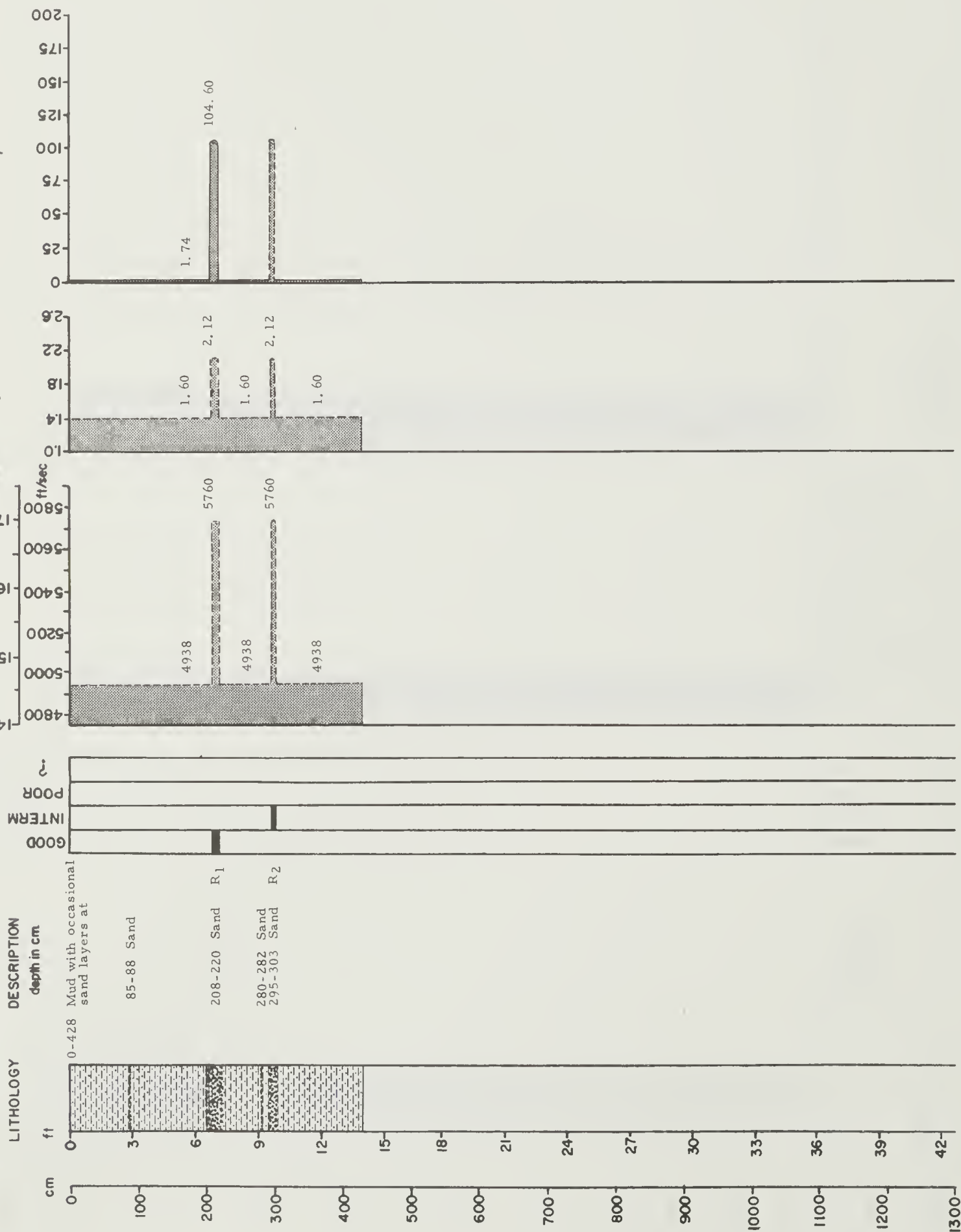
VI5-213 MGS 2-69



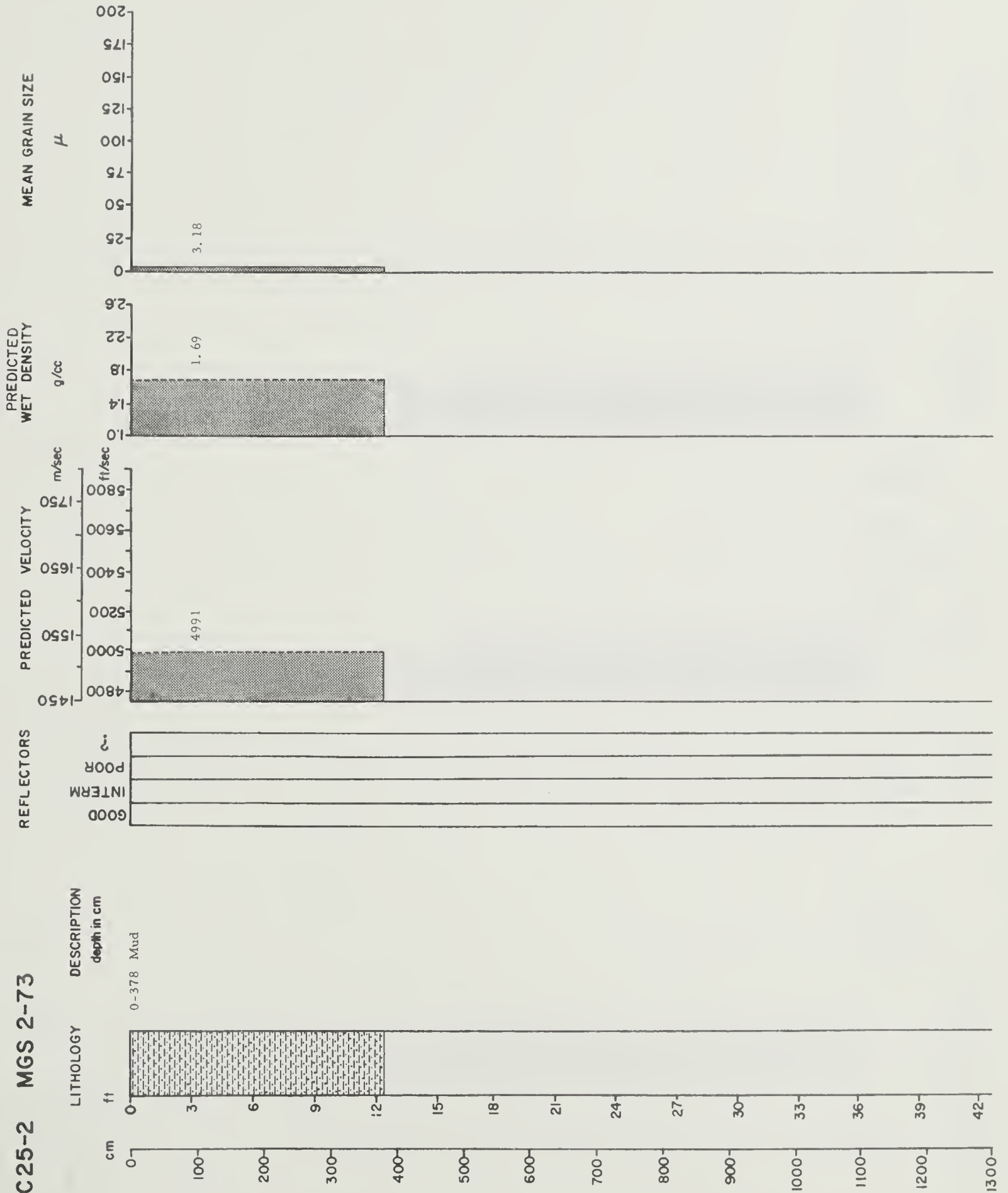
V13-1 MGS 2-70



A164-61 MGS 2-71
MGS 2-72



C25-2 MGS 2-73



V7-69 MGS 2-74

LITHOLOGY DESCRIPTION
depth in cm

0-612 Mud, sandy

cm

ft

LITHOLOGY

DESCRIPTION

depth in cm

REFLECTORS
GOOD
INTERM
POOR
?

PREDICTED
WET DENSITY

g/cc

MEAN GRAIN SIZE

μ

m/sec

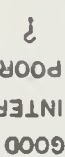
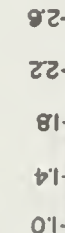
PREDICTED VELOCITY

?

POOR

INTERM

GOOD



cm

ft

LITHOLOGY

DESCRIPTION

depth in cm

0-612 Mud, sandy

REFLECTORS
GOOD
INTERM
POOR
?

PREDICTED
WET DENSITY

g/cc

MEAN GRAIN SIZE

μ

m/sec

PREDICTED VELOCITY

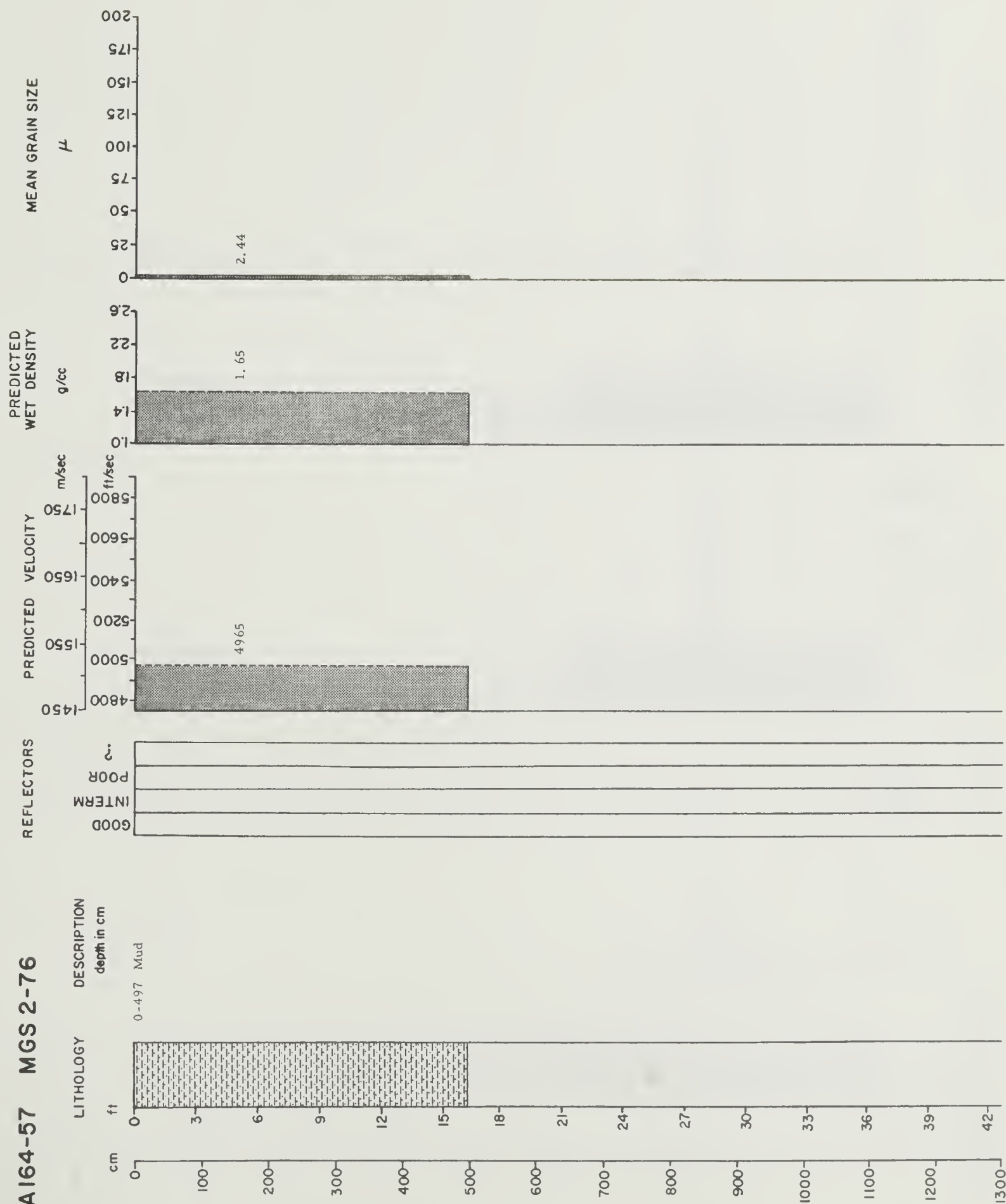
?

POOR

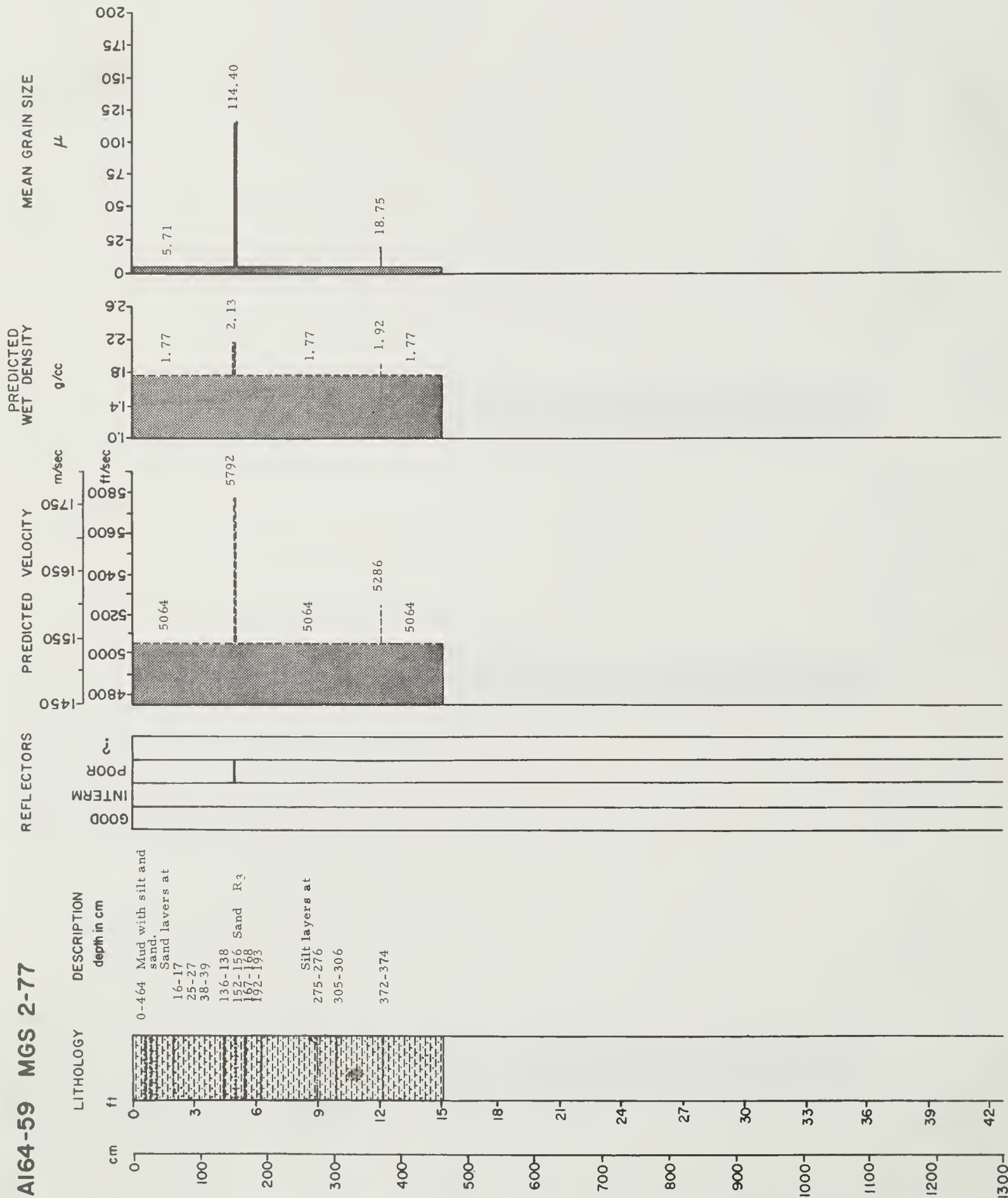
INTERM

GOOD

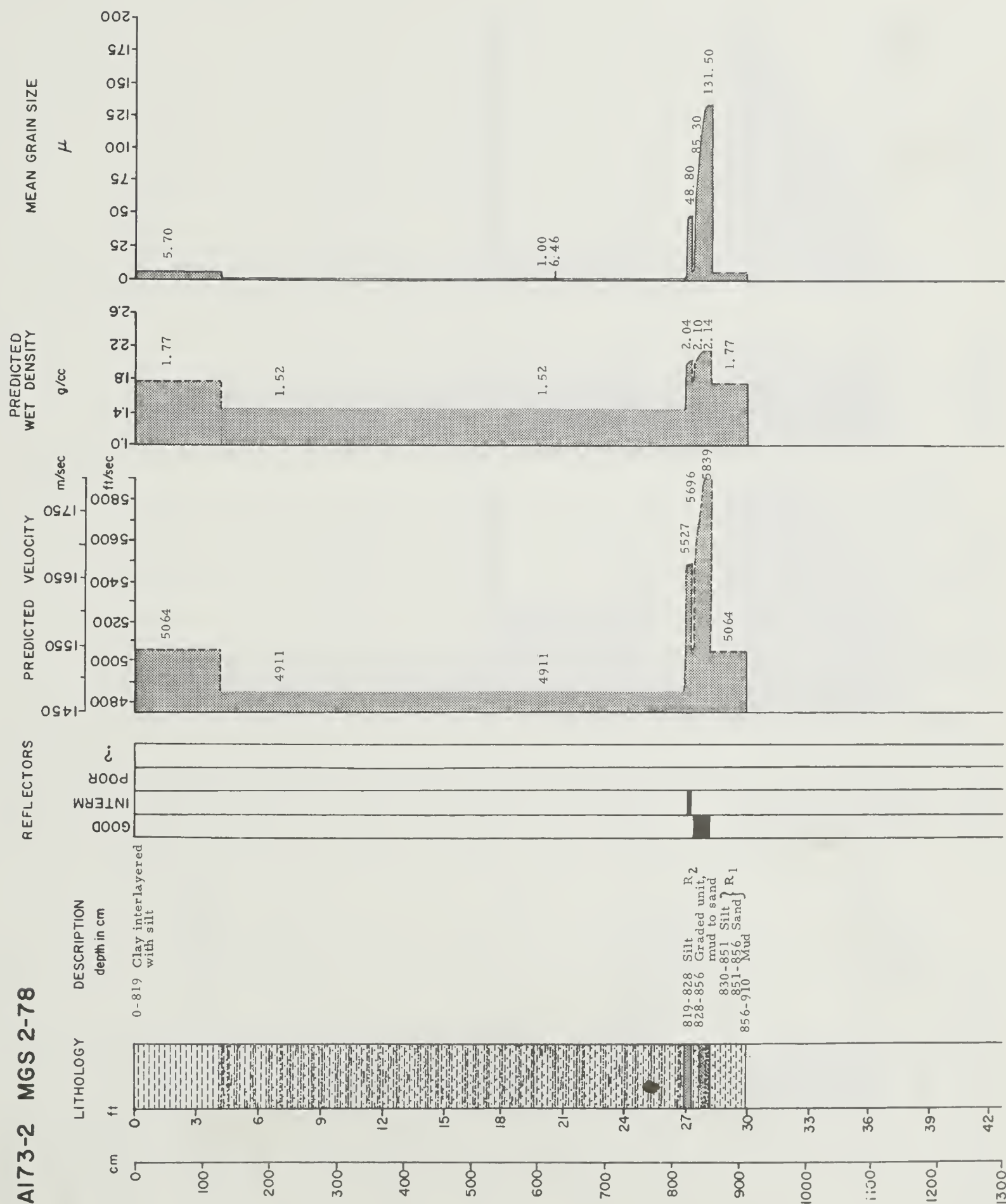
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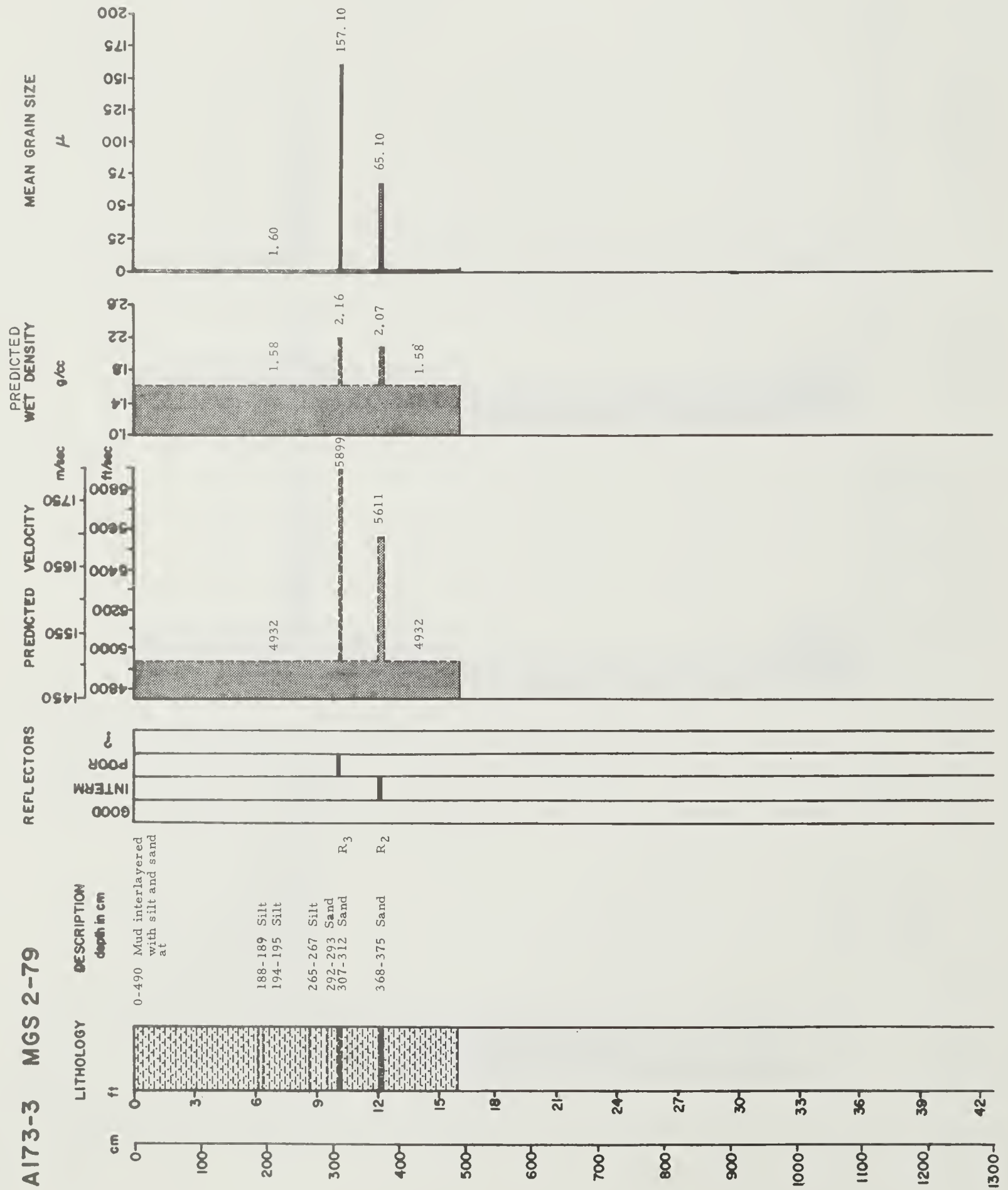


AI64-59 MGS 2-77

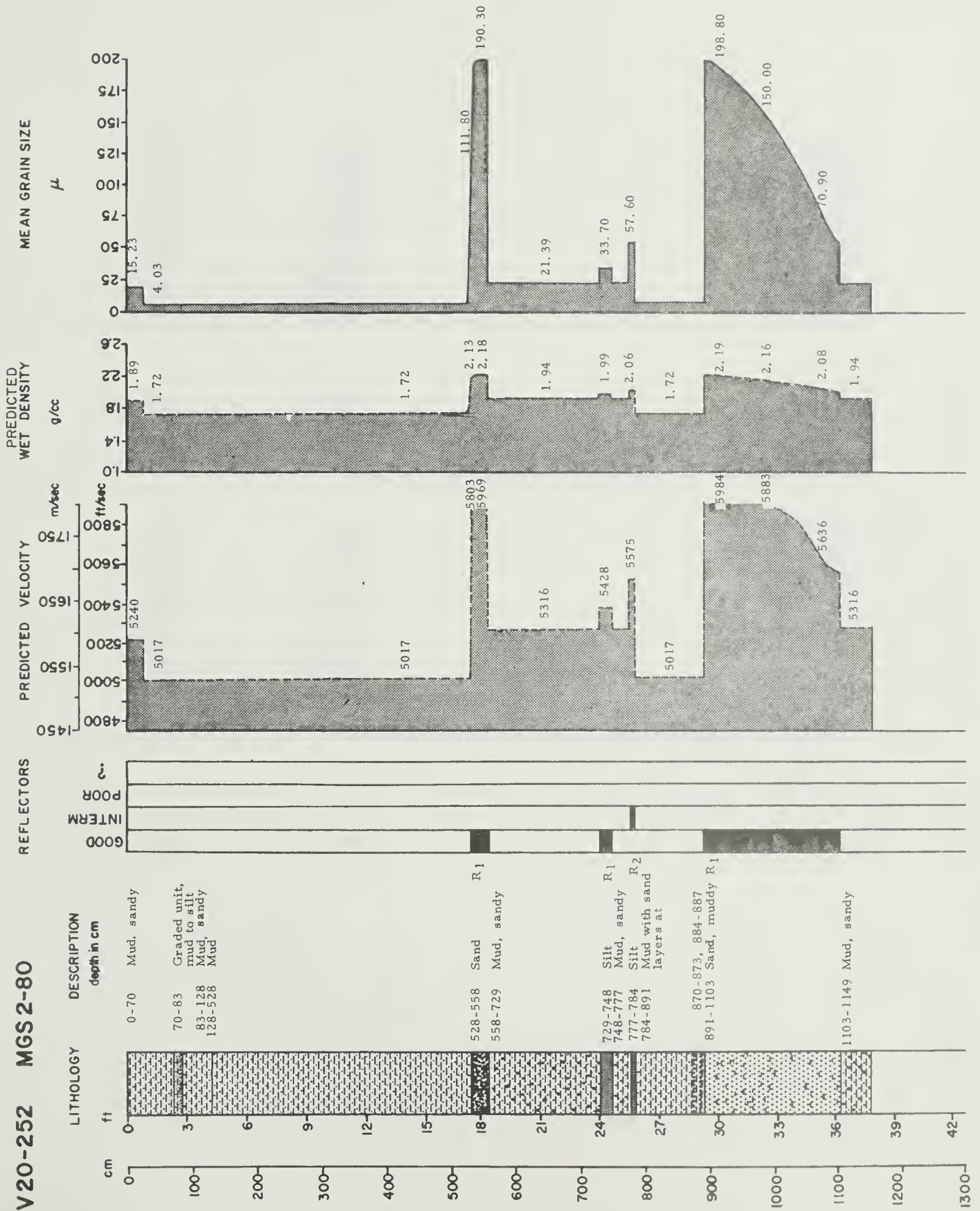


AI73-2 MGS 2-78

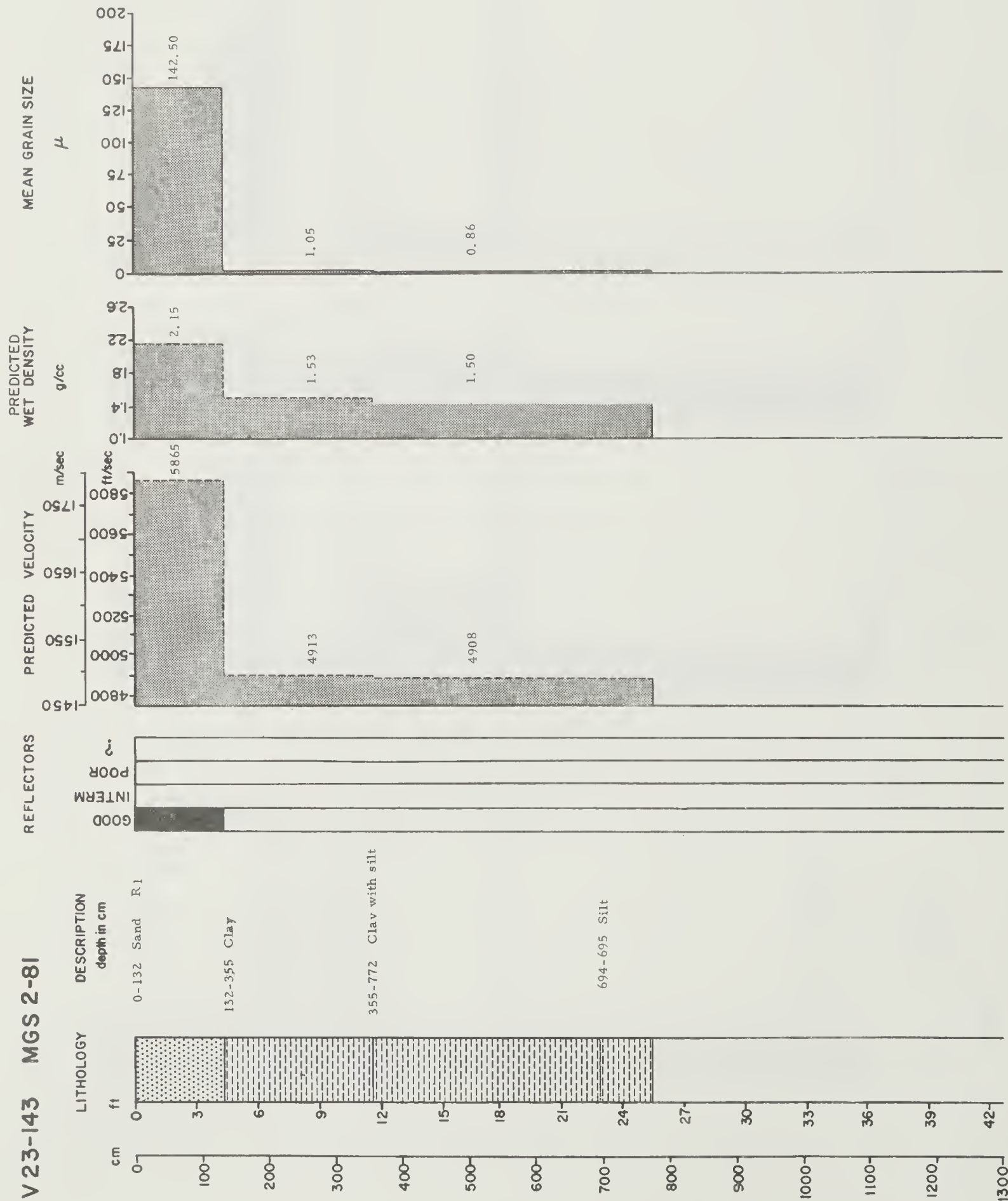




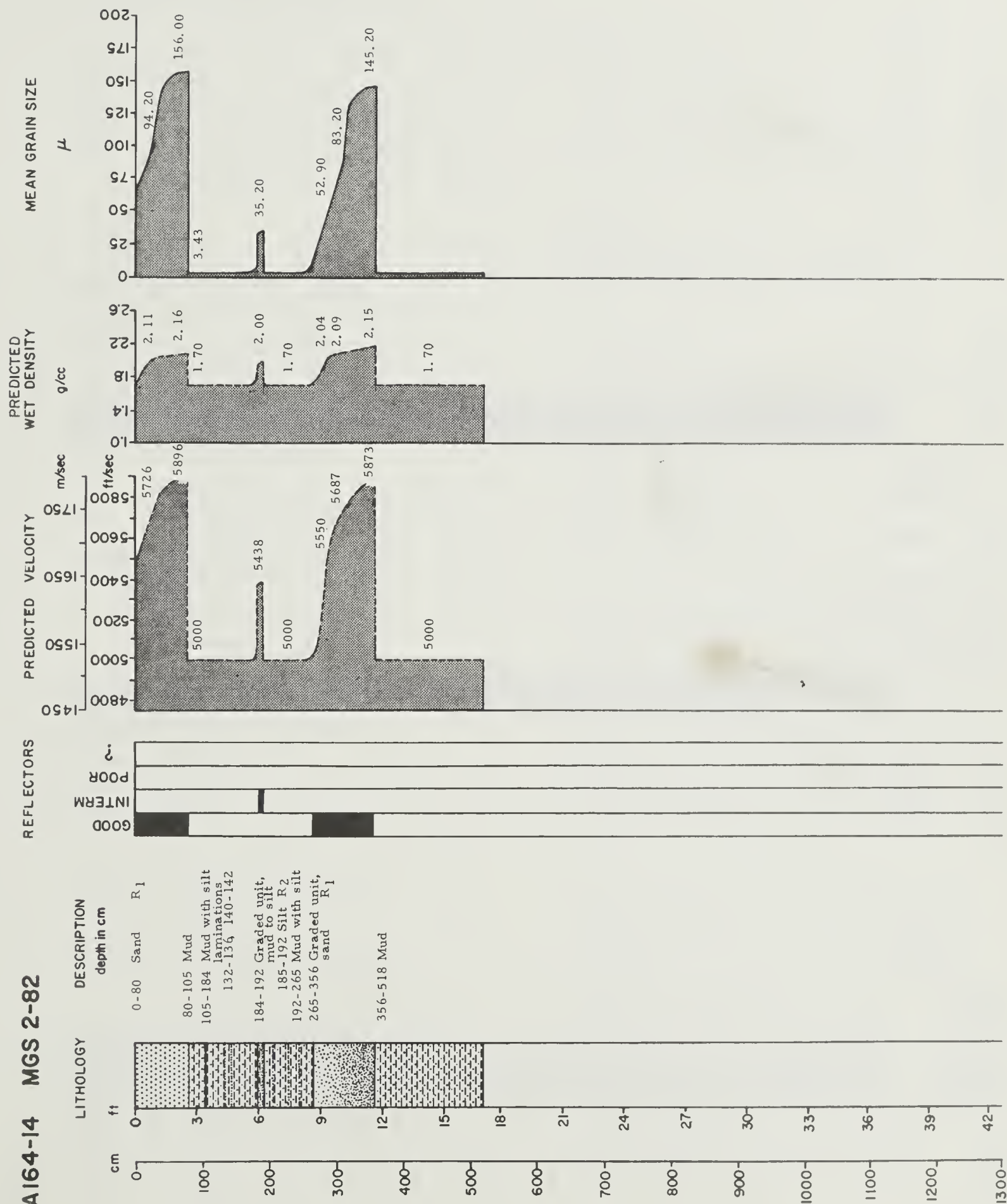
V20-252 MGS 2-80



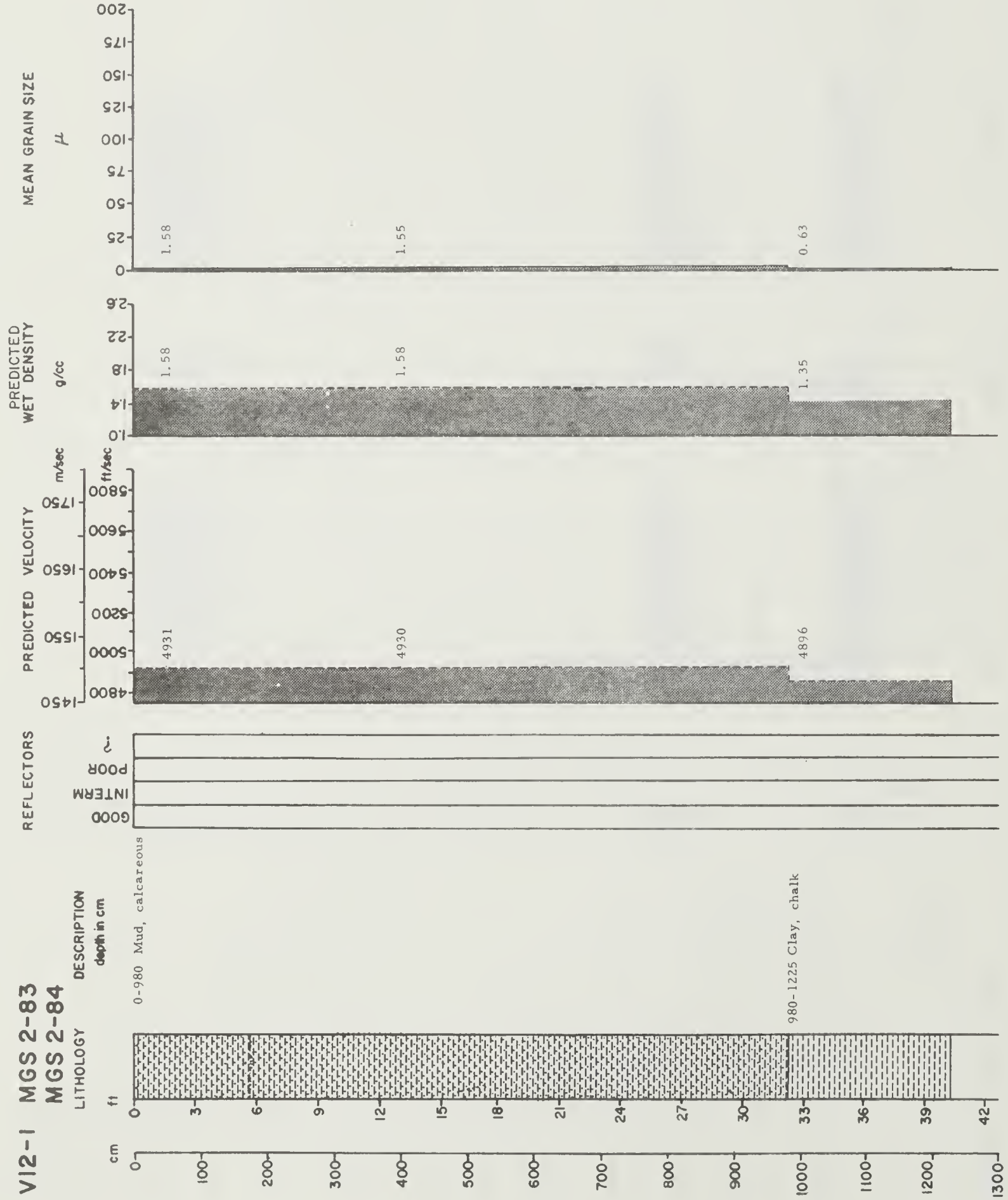
V23-143 MGS 2-81



A164-14 MGS 2-82



V12-1 MGS 2-83
MGS 2-84



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Texture, predictions of sound velocity and wet density, along with position and thickness of potential sound reflectors in 66 piston cores are logged and described. Data have been matched to locations of acoustic stations completed under the Marine Geophysical Survey Project, U.S. Naval Oceanographic Office. Tentative statements are made concerning overall reflectivity of the Hatteras Abyssal Plain. Level areas of the northern half of the Plain should be characterized by very good sound reflection, central areas - moderate reflection, southwest corner good reflection, and southeast corner moderate reflection.

Results suggest that effective use of the seafloor as an acoustic interface requires collaboration of acousticians, marine geologists and sedimentologists.

14.	KEY WORDS	LINK A		LINK B		LINK C	
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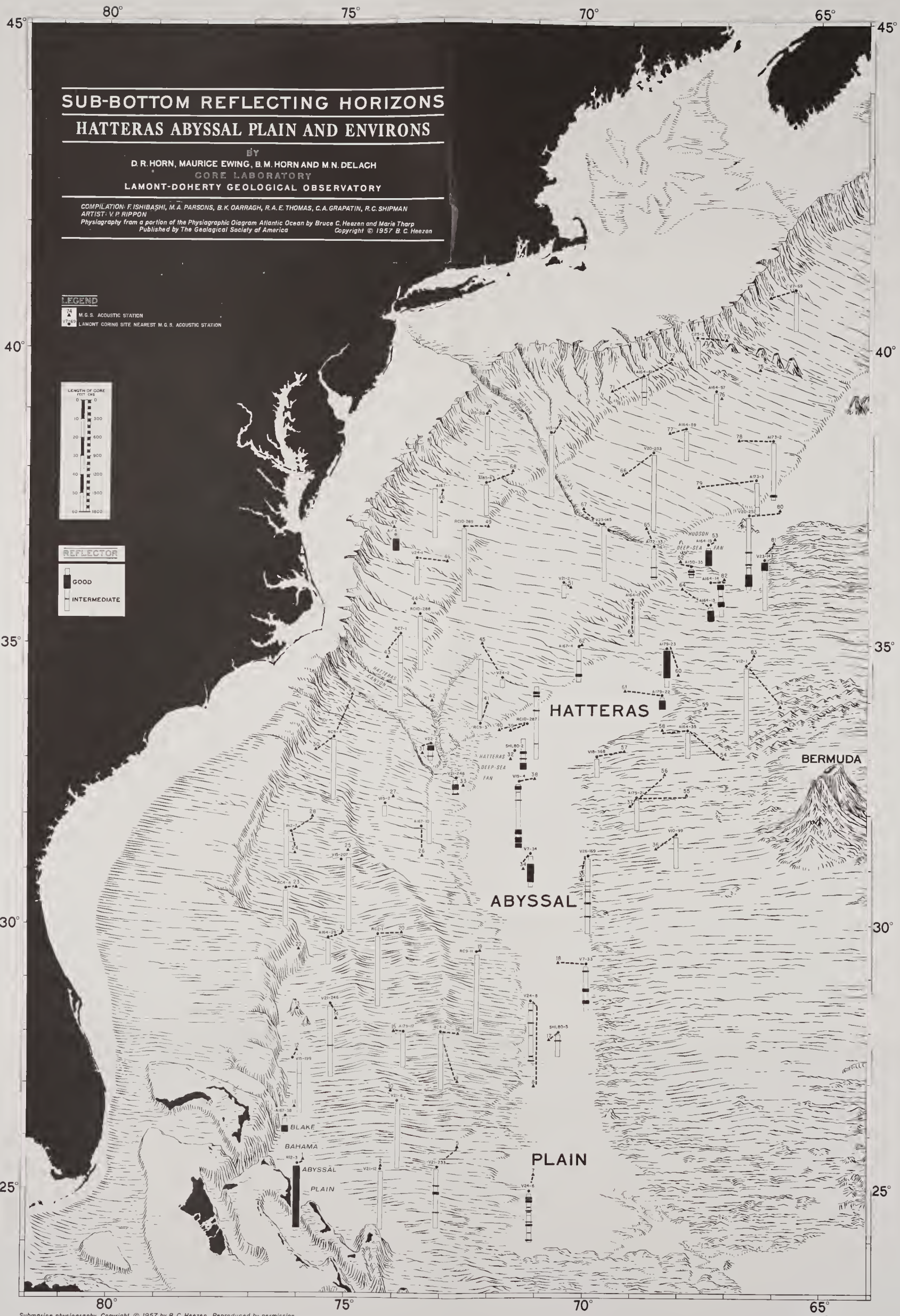
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FIGURE 5



SUB-BOTTOM REFLECTING HORIZONS HATTERAS ABYSSAL PLAIN AND ENVIRONS

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